Section B

Answer **one** question from this Section in the spaces provided.

8 **(a)** State what is meant by the *thermal equilibrium* of two bodies by reference to

(i) temperature,

....

.... [1]

(ii) movement of thermal energy.

....

....

.... [2]

(b) A student carries out an experiment with melting ice, using the apparatus illustrated in Fig. 8.1.

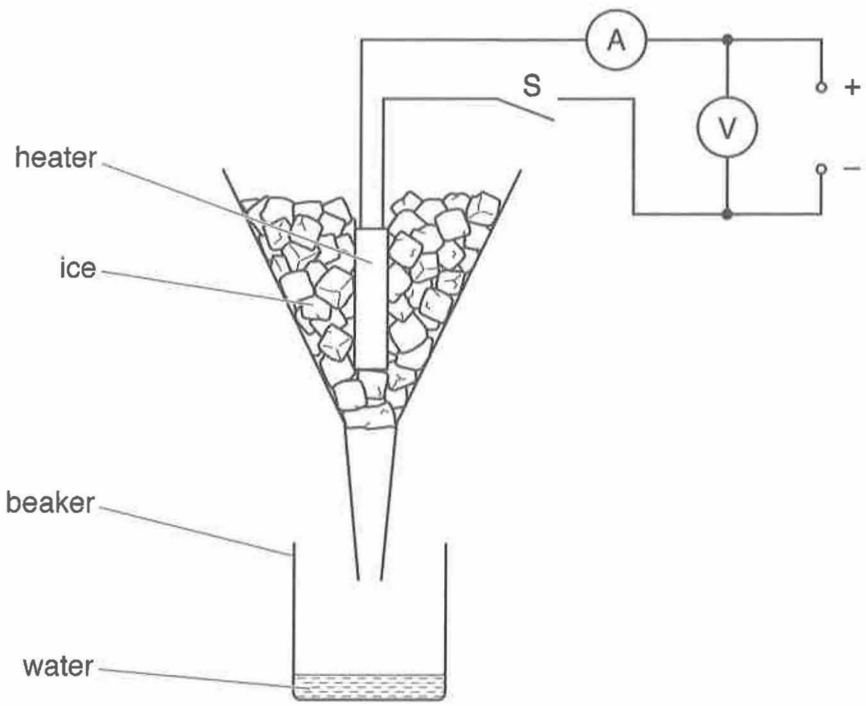

Fig. 8.1

Initially, the switch S is open and the funnel is kept filled with pure melting ice.
Water drips out of the funnel at a constant rate.

(i) Suggest and explain whether the ice is in thermal equilibrium with its surroundings.

....

.... [1]

(ii) The switch S is closed. When water drips out of the funnel at a different constant rate, the beaker is replaced with an empty beaker and the readings shown in Fig. 8.2 are obtained.

ammeter reading /A	voltmeter reading /V	mass of empty beaker/g	mass of beaker plus water/g	time of collection of water /minutes
6.3	12.0	32.4	114.0	5.0

Fig. 8.2

The specific latent heat of fusion of ice is $330\,\mathrm{J\,g^{-1}}$.

Calculate the rate R at which thermal energy is gained from the atmosphere by the ice in the funnel.

R = ... W [3]

(c) (i) By reference to the energy of molecules, explain why the internal energy of an ideal gas is proportional to its thermodynamic temperature.

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.... [4]

(ii) Some neon-20 gas is heated at constant volume so that its pressure and temperature change as shown in Fig. 8.3.

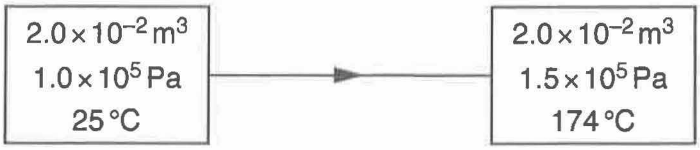

Fig. 8.3

The neon-20 gas is a monatomic gas that may be assumed to behave as an ideal gas.

For the change illustrated in Fig. 8.3 to occur, 1220 J of thermal energy is supplied to the gas.

1. Show that the mass of gas remains constant during the heating process.

[3]

2. Determine the specific heat capacity c of the gas when measured at constant volume.

c = ... $J\,g^{-1}\,K^{-1}$ [3]

(iii) Use the first law of thermodynamics to suggest why the specific heat capacity, as calculated in **(ii)**, would be larger when the heating takes place at constant pressure, rather than at constant volume.

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.... [3]