14. Temperature

14.1 Thermal equilibrium

Paper 4

Question Paper

1 **(a)** With reference to thermal energy, state what is meant by two objects being in thermal equilibrium.

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2 **(a)** State the reason why two objects that are at the same temperature are described as being in thermal equilibrium.

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3 **(b)** A student determines the specific latent heat of vaporisation of a liquid using the apparatus illustrated in Fig. 3.1.

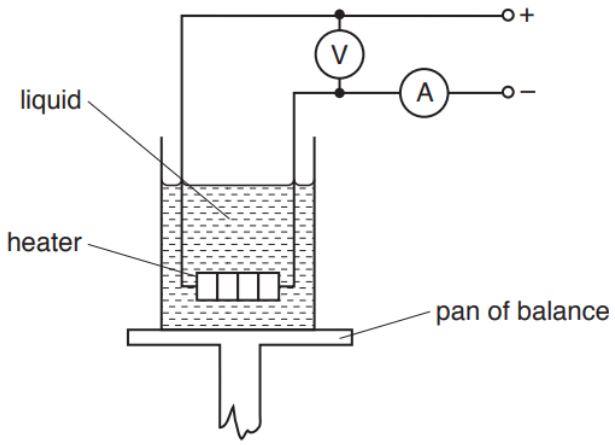


Fig. 3.1

The heater is switched on. When the liquid is boiling at a constant rate, the balance reading is noted at 2.0 minute intervals.

After 10 minutes, the current in the heater is reduced and the balance readings are taken for a further 12 minutes.

The readings of the ammeter and of the voltmeter are given in Fig. 3.2.

	ammeter reading /A	voltmeter reading /V
from time 0 to time 10 minutes	1.2	230
after time 10 minutes	1.0	190

Fig. 3.2

The variation with time of the balance reading is shown in Fig. 3.3.

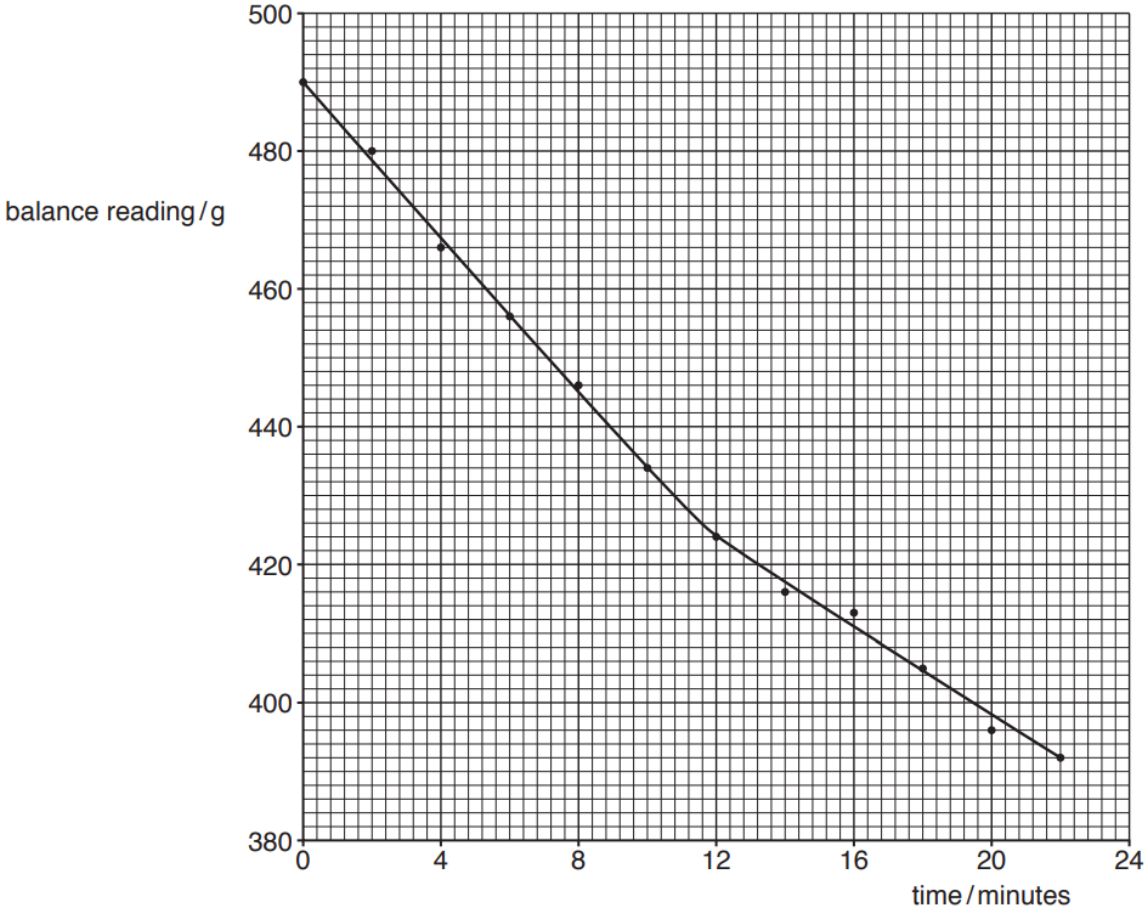


Fig. 3.3

(ii) Explain why, although the power of the heater is changed, the rate of loss of thermal energy to the surroundings may be assumed to be constant.

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4 **(b)** A student uses the apparatus illustrated in Fig. 3.1 to determine a value for the specific latent heat of fusion of ice.

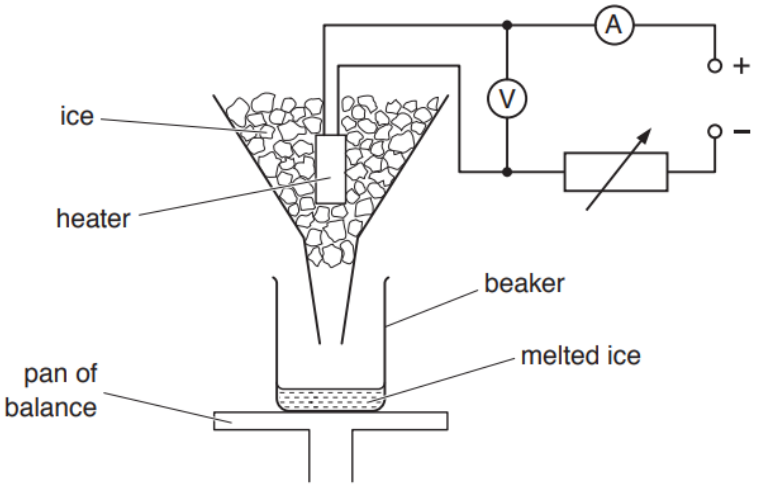


Fig. 3.1

The balance reading measures the mass of the beaker and the melted ice (water) in the beaker.

The heater is switched on and pieces of ice at 0 °C are added continuously to the funnel so that the heater is always surrounded by ice.

When water drips out of the funnel at a constant rate, the balance reading is noted at 2.0 minute intervals. After 10 minutes, the current in the heater is increased and the balance readings are taken for a further 12 minutes.

The variation with time of the balance reading is shown in Fig. 3.2.

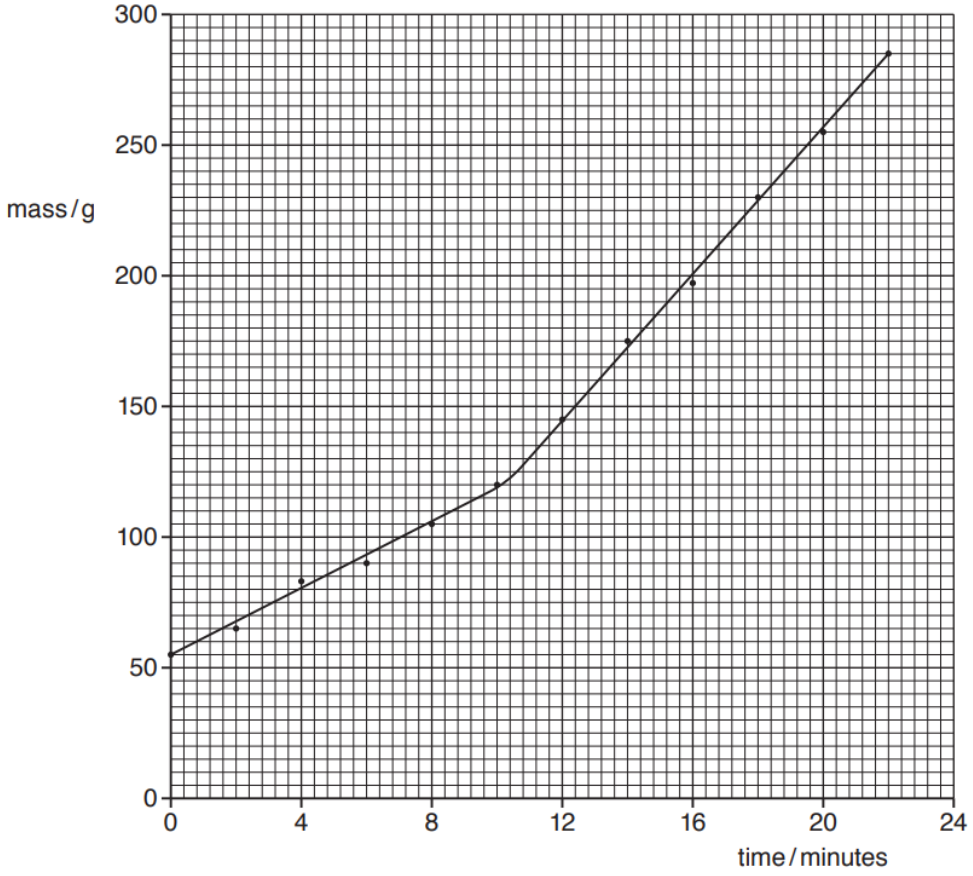


Fig. 3.2

The readings of the ammeter and of the voltmeter are shown in Fig. 3.3.

	ammeter reading /A	voltmeter reading /V
from time 0 to time 10 minutes after time 10 minutes	1.8 3.6	7.3 15.1

Fig. 3.3

(ii) Explain why, although the power of the heater is changed, the rate at which thermal energy is transferred from the surroundings to the ice is constant.

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