Thermal Properties of Materials

Question paper 1

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Thermal Properties of Materials
Sub Topic	
Paper Type	Theory
Booklet	Question paper 1

Time Allowed: **59 minutes**

Score: **/49**

Percentage: **/100**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 Distinguish between *melting* and *evaporation*.

melting: .....

.....

.....

evaporation: .....

.....

.....

[4]

2 Distinguish between *evaporation* and *boiling*.

evaporation: .....

.....

.....

boiling: .....

.....

.....

[4]

3 **(a)** **(i)** State one **similarity** between the processes of evaporation and boiling.

.....

..... [1]

(ii) State two **differences** between the processes of evaporation and boiling.

1. .....

.....

2. .....

.....

[4]

(b) Titanium metal has a density of 4.5 g cm^{-3}.

A cube of titanium of mass 48 g contains 6.0×10^{23} atoms.

(i) Calculate the volume of the cube.

volume = ... cm^3 [1]

(ii) Estimate

1. the volume occupied by each atom in the cube,

volume = ... cm^3 [1]

2. the separation of the atoms in the cube.

separation = ... cm [1]

4 **(a)** Explain what is meant by the *internal energy* of a substance.

.....

.....

..... [2]

(b) State and explain, in molecular terms, whether the internal energy of the following increases, decreases or does not change.

(i) a lump of iron as it is cooled

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.....

.....

..... [3]

(ii) some water as it evaporates at constant temperature

.....

.....

.....

..... [3]

5 **(a)** State what is meant by *internal energy*.

.....

.....

..... [2]

(b) The variation with volume V of the pressure p of an ideal gas as it undergoes a cycle ABCA of changes is shown in Fig. 2.1.

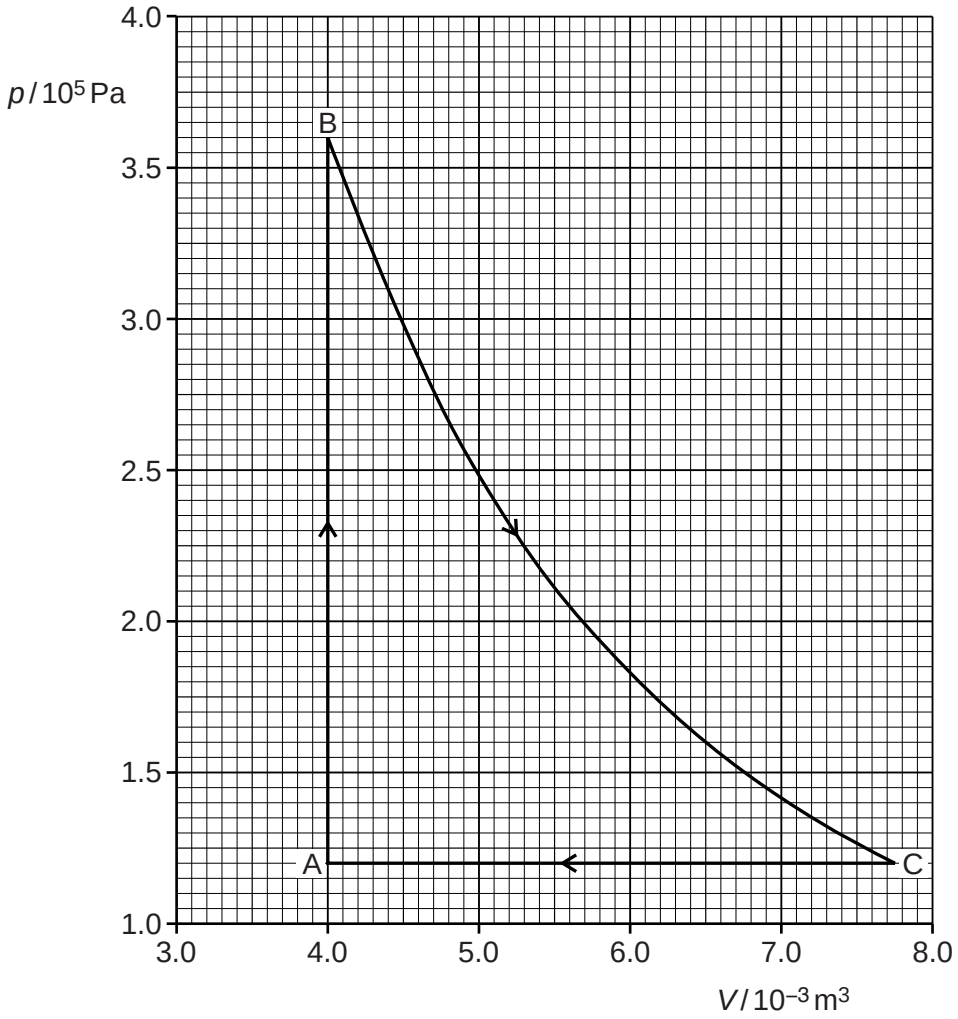

Fig. 2.1

The temperature of the gas at A is 290 K. The temperature at B is 870 K.

Determine

(i) the amount, in mol, of gas,

amount = ... mol [2]

(ii) the temperature of the gas at C.

temperature = ... K [2]

(c) Explain why the change from C to A involves external work and a change in internal energy.

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..... [2]

6 **(a)** Define *specific latent heat*.

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..... [2]

(b) An electrical heater is immersed in some melting ice that is contained in a funnel, as shown in Fig. 3.1.

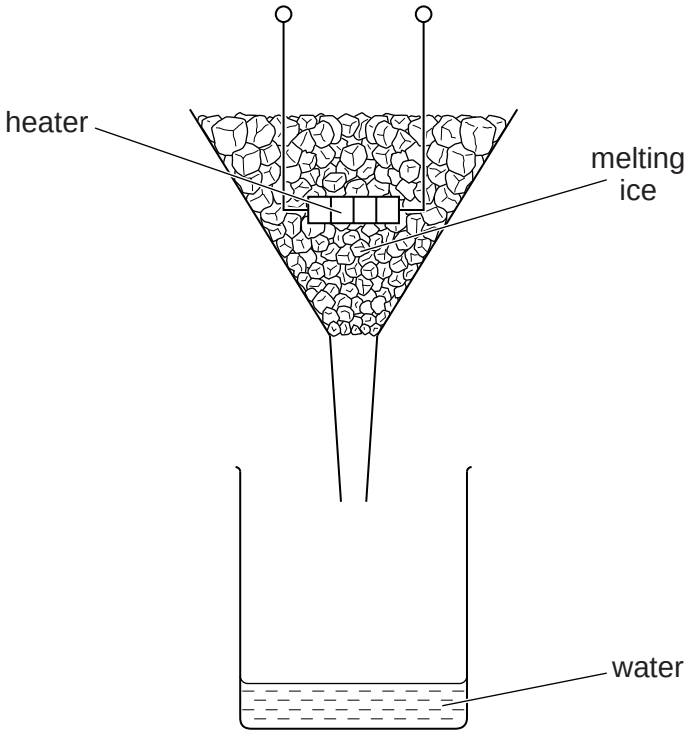

Fig. 3.1

The heater is switched on and, when the ice is melting at a constant rate, the mass *m* of ice melted in 5.0 minutes is noted, together with the power *P* of the heater. The power *P* of the heater is then increased. A new reading for the mass *m* of ice melted in 5.0 minutes is recorded when the ice is melting at a constant rate.

Data for the power *P* and the mass *m* are shown in Fig. 3.2.

power of heater P / W	mass m melted in 5.0 minutes / g	mass m melted per second / g s^{-1}
70	78	.....
110	114	.....

Fig. 3.2

(i) Complete Fig. 3.2 to determine the mass melted per second for each power of the heater. [2]

(ii) Use the data in the completed Fig. 3.2 to determine

1. a value for the specific latent heat of fusion *L* of ice,

L = ... $J g^{-1}$ [3]

2. the rate *h* of thermal energy gained by the ice from the surroundings.

h = ... W [2]

7 **(a)** Define *specific latent heat*.

.....

.....

.....[2]

(b) A beaker containing a liquid is placed on a balance, as shown in Fig. 3.1.

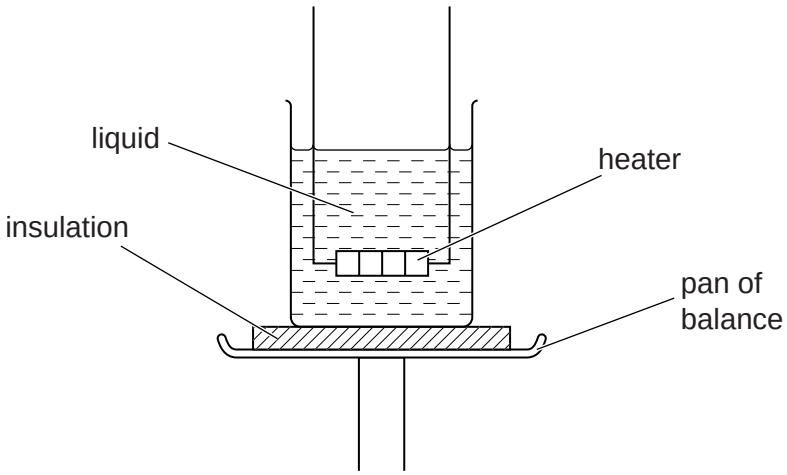

Fig. 3.1

A heater of power 110W is immersed in the liquid. The heater is switched on and, when the liquid is boiling, balance readings *m* are taken at corresponding times *t*.

A graph of the variation with time *t* of the balance reading *m* is shown in Fig. 3.2.

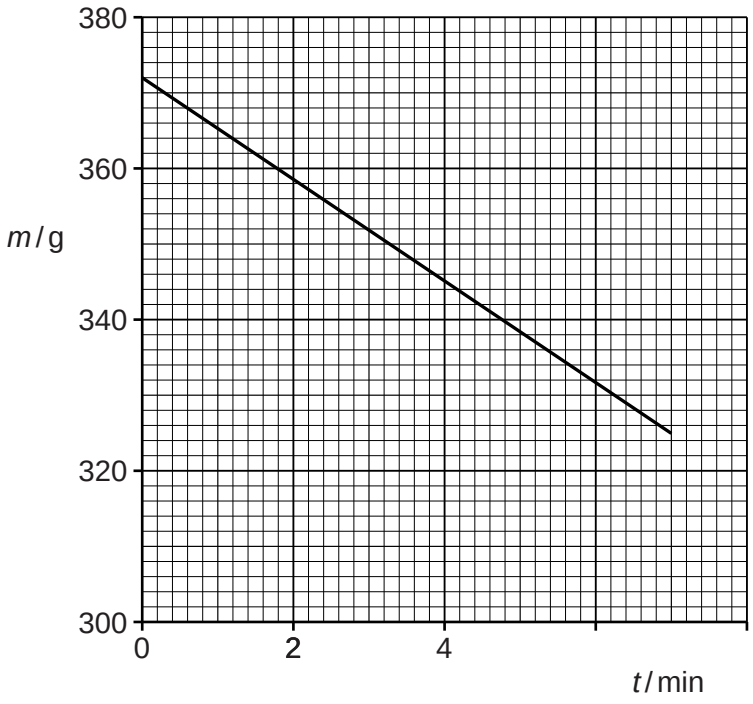

Fig. 3.2

(i) State the feature of Fig. 3.2 which suggests that the liquid is boiling at a steady rate.

.....

.....[1]

(ii) Use data from Fig. 3.2 to determine a value for the specific latent heat *L* of vaporisation of the liquid.

L = ... $J kg^{-1}$ [3]

(iii) State, with a reason, whether the value determined in **(ii)** is likely to be an overestimate or an underestimate of the normally accepted value for the specific latent heat of vaporisation of the liquid.

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.....[2]