For Examiner's Use

2 A fixed mass of monatomic ideal gas is being studied for its thermodynamic properties.

(a) State what is meant by an *ideal gas*.

……

……

……

…… [2]

(b) The gas is initially placed in a container of volume 2.3×10^4 cm^3 and at a pressure of 4.8×10^5 Pa. The temperature of the gas is 65 °C.

(i) Determine the number of atoms in the gas.

number = …… [2]

(ii) Determine the internal energy of this gas at 65 °C.

internal energy = …… J [2]

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(iii) The temperature is then increased to 75 °C.

Determine the ratio of

$$\frac{\text{root-mean-square (r.m.s.) speed of the gas molecules at 65 °C}}{\text{root-mean-square (r.m.s.) speed of the gas molecules at 75 °C}}.$$

ratio = …… [2]

(c) The gas then undergoes a cycle of processes ABC as shown in Fig. 2.1.

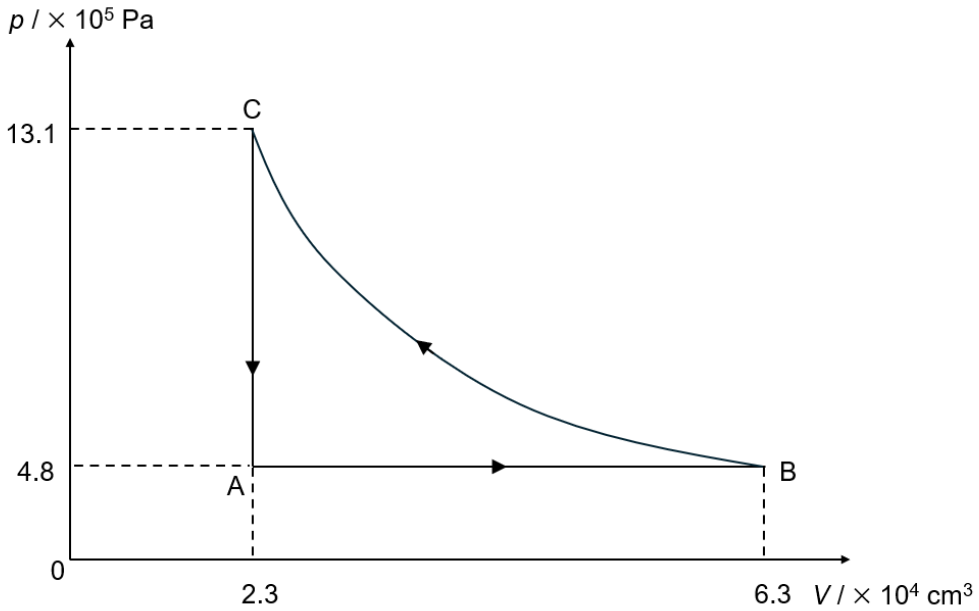

Fig. 2.1

During the isobaric process A→B, the gas expands from 2.3×10^4 cm^3 to 6.3×10^4 cm^3 at a constant pressure of 4.8×10^5 Pa.

During the isothermal process B→C, the gas contracts from 6.3×10^4 cm^3 to 2.3×10^4 cm^3 and the pressure increases to 13.1×10^5 Pa.

During the isovolumetric process C→A, the gas reduces in pressure to 4.8×10^5 Pa.

[Turn over

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(i) Explain why process B→C is isothermal.

……..

……... [1]

(ii) Complete Table 2.1. Show your working.

Table 2.1

process	work done on the gas / $\times 10^4$ J	heat supplied to the gas / $\times 10^4$ J	increase in internal energy / $\times 10^4$ J
A → B			
B → C	3.05		0
C → A			−2.88

[3]

[Total: 12]