

2 A cylinder contains 5.12 mol of an ideal gas at pressure of  $5.60 \times 10^5$  Pa and volume  $3.80 \times 10^4$  cm<sup>3</sup>.

(a) Determine the temperature of the gas.

temperature = ..... K [2]

(b) The average kinetic energy  $E_K$  of a molecule of the gas is given by the expression

$$E_K = \frac{3}{2} kT$$

where  $k$  is the Boltzmann constant and  $T$  is the thermodynamic temperature.

The gas is heated at constant pressure so that its temperature rises by 125 K.

(i) Use your answer in (a) to determine the new volume of the gas.

volume = ..... cm<sup>3</sup> [2]

(ii) Calculate the increase in internal energy of the gas. Explain your working.

increase in internal energy = ..... J [3]

- (c) (i) Use your answer in (b)(i) to determine the external work done during the expansion of the gas.

work done = ..... J [2]

- (ii) Calculate the total thermal energy required to heat the gas in (b).

energy = ..... J [1]

[Total: 10]