For Examiner Use

2 A mass of 5.6 g of nitrogen gas occupies a volume of $4.6 \times 10^3 \text{cm}^3$ at a pressure of $1.0 \times 10^5 \text{Pa}$ and a temperature of 280 K. The specific heat capacity of nitrogen gas, when heated at constant volume, is $0.73 \text{J g}^{-1} \text{K}^{-1}$. Nitrogen may be assumed to be an ideal gas.

(a) Calculate the thermal energy required to raise the temperature of the gas by 1 K at constant volume.

energy = ... J [2]

(b) The temperature of the gas is raised from 280 K to 281 K at constant pressure.

Determine, for this temperature change,

(i) the change in volume of the gas,

volume change = ... cm^3 [2]

(ii) the external work done by the gas.

work done = ... J [2]

For Examiner's Use

(c) **(i)** State the *first law of thermodynamics*, indicating the directions of all energy changes.

.....

.....

.....[2]

(ii) Use the first law and your answers in **(a)** and **(b)** to determine the thermal energy required to raise the temperature of the nitrogen gas from 280 K to 281 K when the gas is heated at constant pressure.

energy = ... J [1]