2 **(a)** The volume of an ideal gas in a cylinder is $1.80 \times 10^{-3}\,m^3$ at a pressure of $2.60 \times 10^5\,Pa$ and a temperature of 297 K, as illustrated in Fig. 2.1.

For Examiner's Use

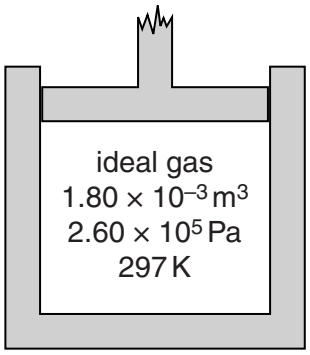

Fig. 2.1

The thermal energy required to raise the temperature by 1.00 K of 1.00 mol of the gas at constant volume is 12.5 J.

The gas is heated at constant volume such that the internal energy of the gas increases by 95.0 J.

(i) Calculate

1. the amount of gas, in mol, in the cylinder,

amount = ... mol [2]

2. the rise in temperature of the gas.

temperature rise = ... K [2]

(ii) Use your answer in **(i) part 2** to show that the final pressure of the gas in the cylinder is 2.95×10^5 Pa.

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[1]

(b) The gas is now allowed to expand. No thermal energy enters or leaves the gas. The gas does 120 J of work when expanding against the external pressure.

State and explain whether the final temperature of the gas is above or below 297 K.

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..... [3]