5 **(a)** State the first law of thermodynamics.

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..... [1]

(b) Fig. 5.1 shows a fixed mass of an ideal gas in a cylinder with a freely moving piston. The gas has an initial pressure of 400 kPa and an initial volume of 0.50×10^{-3} m^3.

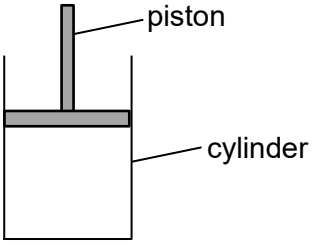

Fig. 5.1

When heat is supplied to the gas, it expands at a constant temperature to a final volume of 2.00×10^{-3} m^3.

(i) On Fig. 5.2, draw the variation with volume V of the pressure P of the gas from the initial volume to the final volume. [2]

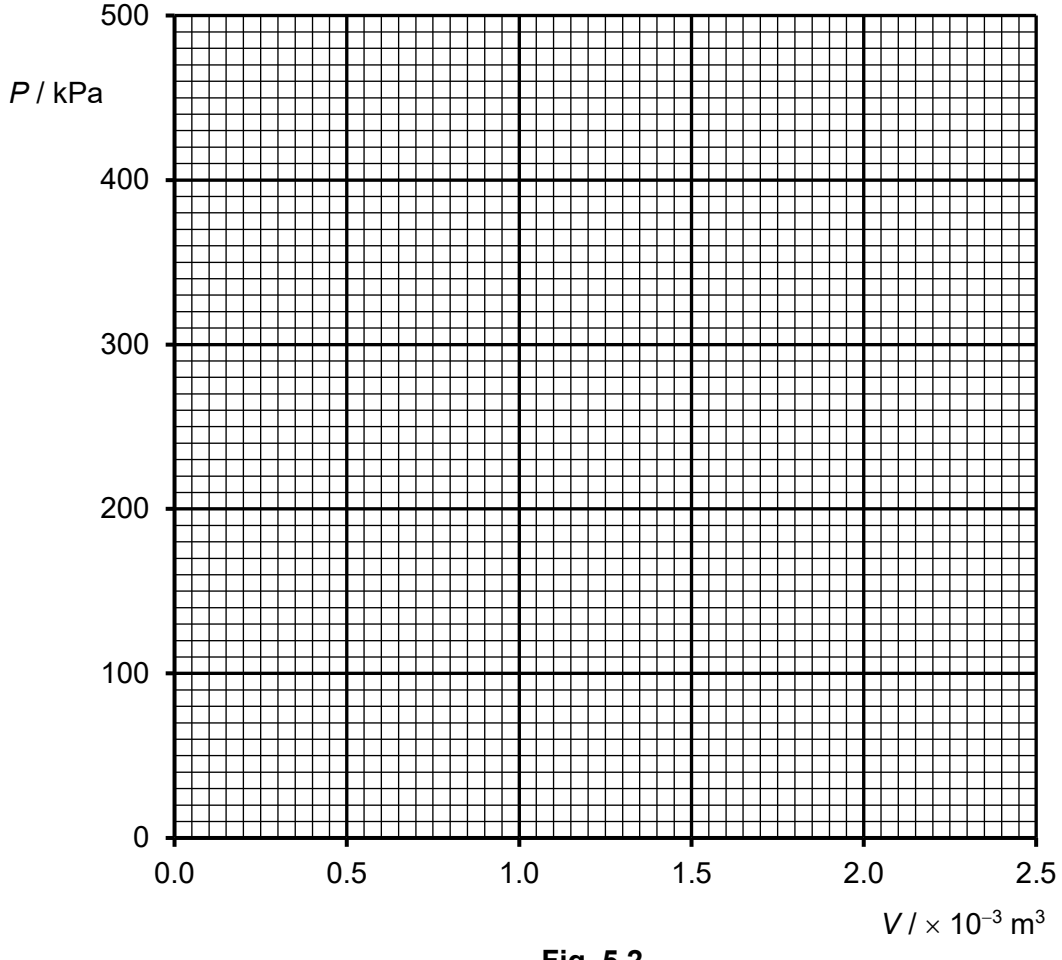

Fig. 5.2

(ii) Explain why the amount of heat supplied to the gas is numerically equal to the area under the graph you have drawn in **(i)**.

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..... [2]

(c) Two experiments are carried out using two identical sets of cylinders with freely moving pistons as shown in Fig. 5.3.

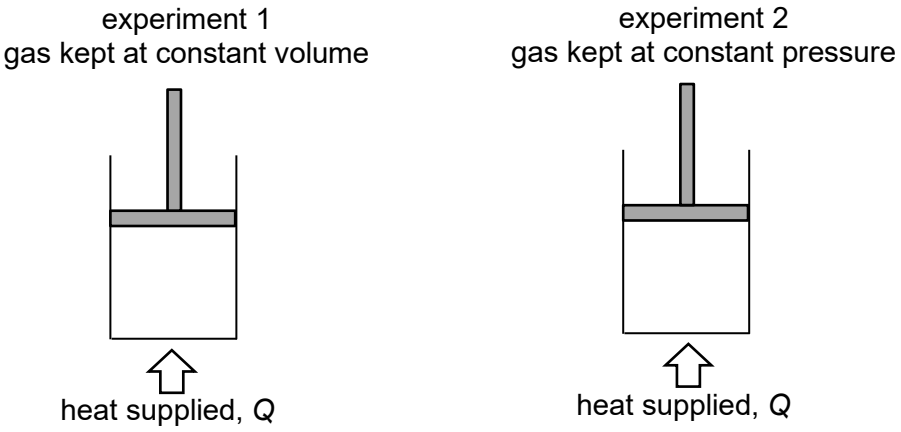

Fig. 5.3

Both cylinders contain ideal gas with the same initial temperature, pressure and volume.

In experiment 1, an amount of heat Q is supplied to the gas kept at constant volume.
In experiment 2, the same amount of heat Q is supplied to the gas kept at constant pressure.

State and explain which gas will have a higher final temperature.

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..... [3]

[Total: 8]