3 **(a)** With reference to molecular kinetic energy and molecular potential energy, explain what is meant by the internal energy of an ideal gas.

.....

.....

..... [2]

(b) A sample of an ideal gas is initially in state A, at a pressure of 2.0×10^5 Pa and with a volume of $0.016\,m^3$, as shown in Fig. 3.1.

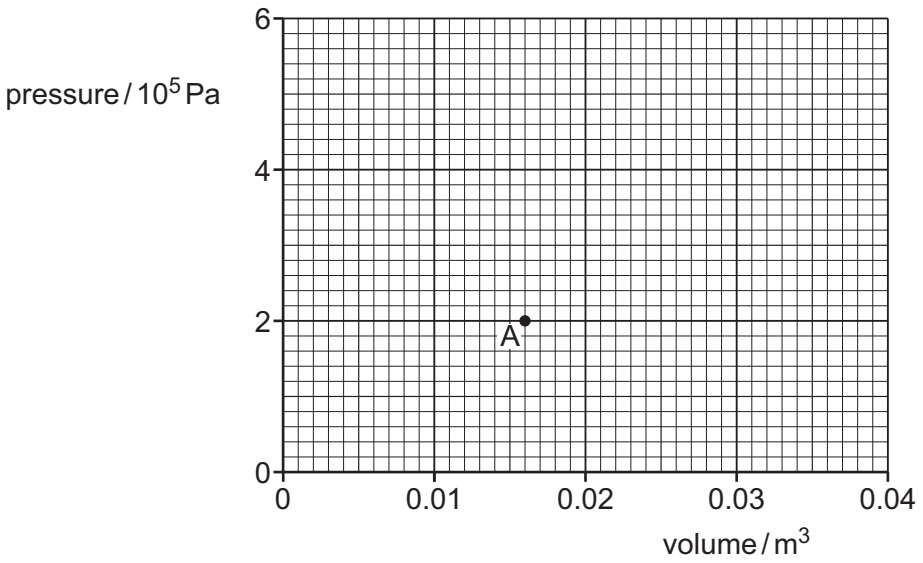

Fig. 3.1

In state A, the temperature of the gas is 400 K.

The gas undergoes two successive changes X and Y.

In change X, it is heated at constant volume to a pressure of 4.0×10^5 Pa. At the end of change X, the gas is in state B.

In change Y, it is then allowed to expand at constant temperature back to its original pressure. At the end of change Y, the gas is in state C.

(i) Determine the internal energy of the gas in state A.

internal energy = ... J [2]

(ii) Determine the temperature of the gas in state B.

temperature = ... K [1]

(iii) Determine the volume of the gas in state C.

volume = ... m^3 [1]

(iv) On Fig. 3.1, draw two lines, one to represent change X and one to represent change Y. Label your lines X and Y respectively. [3]

[Total: 9]