2 **(a)** The first law of thermodynamics can be represented by the expression

$$\Delta U = q + w.$$

State what is meant by the symbols in the expression.

$+\Delta U$ .....

$+q$ .....

$+w$ .....

[2]

(b) A fixed mass of an ideal gas undergoes a cycle ABCA of changes, as shown in Fig. 2.1.

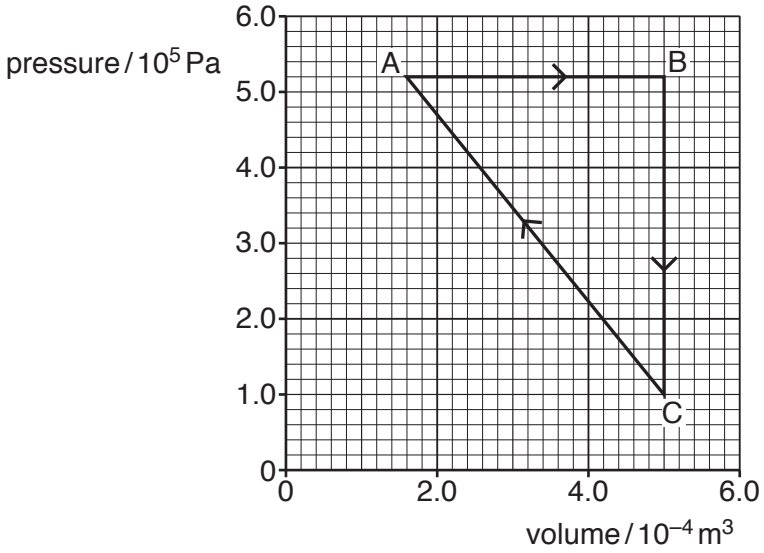

Fig. 2.1

(i) During the change from A to B, the energy supplied to the gas by heating is 442 J.

Use the first law of thermodynamics to show that the internal energy of the gas increases by 265 J.

[2]

(ii) During the change from B to C, the internal energy of the gas decreases by 313 J.

By considering molecular energy, state and explain qualitatively the change, if any, in the temperature of the gas.

.....

.....

.....

.....

.....[3]

(iii) For the change from C to A, use the data in **(b)(i)** and **(b)(ii)** to calculate the change in internal energy.

change in internal energy = ...J [1]

(iv) The temperature of the gas at point A is 227 °C. Calculate the number of molecules in the fixed mass of the gas.

number = ...[2]

[Total: 10]