5 **(a)** **(i)** State what is meant by an ideal gas.

.....

.....[1]

(ii) State the *first law of thermodynamics*.

.....

.....

.....[2]

(b) Air contains oxygen and nitrogen molecules. An oxygen molecule has a mass of $32u$ while a nitrogen molecule has a mass of $28u$. Determine the ratio of the root-mean-square speed of oxygen to nitrogen molecules at the same temperature.

ratio = ...[2]

(c) An ideal gas is contained in a thermally insulated container by means of a piston as shown in Fig. 5.1.

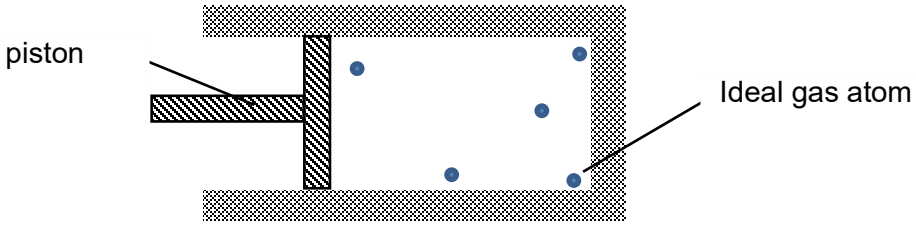

Fig. 5.1

The piston is now moved to the right so that the volume of the gas is reduced. The temperature of the gas increases.

(i) Use the *kinetic theory of gases* to explain why the temperature of the gas increases.

.....

.....

.....[2]

(ii) Use the *first law of thermodynamics* to explain why the temperature of the gas increases.

.....

.....

.....[2]

(d) Explain why the process in **(c)** cannot be a constant pressure process.

.....

.....[1]