2 **(a)** The kinetic theory of gases is based on some simplifying assumptions.
The molecules of the gas are assumed to behave as hard elastic identical spheres.
State the assumption about ideal gas molecules based on

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(i) the nature of their movement,

.....

..... [1]

(ii) their volume.

.....

.....

..... [2]

(b) A cube of volume V contains N molecules of an ideal gas. Each molecule has a component c_X of velocity normal to one side S of the cube, as shown in Fig. 2.1.

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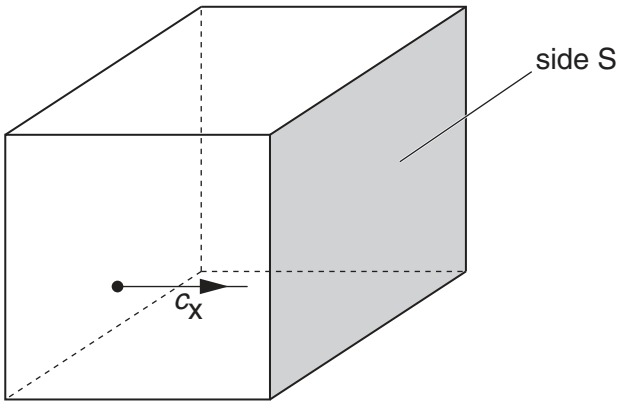

Fig. 2.1

The pressure p of the gas due to the component c_X of velocity is given by the expression

$$pV = Nmc_X^2$$

where m is the mass of a molecule.

Explain how the expression leads to the relation

$$pV = \frac{1}{3}Nm\langle c^2\rangle$$

where $\langle c^2\rangle$ is the mean square speed of the molecules.

[3]

(c) The molecules of an ideal gas have a root-mean-square (r.m.s.) speed of 520 m s^{-1} at a temperature of 27 °C.

Calculate the r.m.s. speed of the molecules at a temperature of 100 °C.

r.m.s. speed = ... m s^{-1} [3]