

- 2** The product of the pressure  $p$  and the volume  $V$  of an ideal gas is given by the expression

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

where  $m$  is the mass of one molecule of the gas.

- (a)** State the meaning of the symbol

**(i)**  $N$ ,

..... [1]

**(ii)**  $\langle c^2 \rangle$ .

..... [1]

- (b)** The product  $pV$  is also given by the expression

$$pV = NkT.$$

Deduce an expression, in terms of the Boltzmann constant  $k$  and the thermodynamic temperature  $T$ , for the mean kinetic energy of a molecule of the ideal gas.

[2]

- (c)** A cylinder contains 1.0 mol of an ideal gas.

**(i)** The volume of the cylinder is constant.

Calculate the energy required to raise the temperature of the gas by 1.0 kelvin.

energy = ..... J [2]

- (ii)** The volume of the cylinder is now allowed to increase so that the gas remains at constant pressure when it is heated.

Explain whether the energy required to raise the temperature of the gas by 1.0 kelvin is now different from your answer in (i).

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[2]