

- 4 (a) The equation of state for an ideal gas may be written as

$$pVA = NBT$$

where p is the pressure of the gas, V is the volume of the gas, A is the Avogadro constant, B is another constant and N is the number of molecules of the gas.

- (i) State the meaning, in the equation, of the symbol T .

..... [1]

- (ii) Identify the constant B .

..... [1]

- (b) The product pV for an ideal gas is also given by

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

- (i) State the meanings, in this equation, of the symbols m and $\langle c^2 \rangle$.

m :

$\langle c^2 \rangle$:

[2]

- (ii) Use the equations in (a) and (b) to derive an expression, in terms of A , B and T , for the mean kinetic energy E_K of a molecule of the gas.

$$E_K = \dots\dots\dots [2]$$

- (c) On Fig. 4.1, sketch the variation with T of the root-mean-square (r.m.s.) speed of the molecules of an ideal gas.

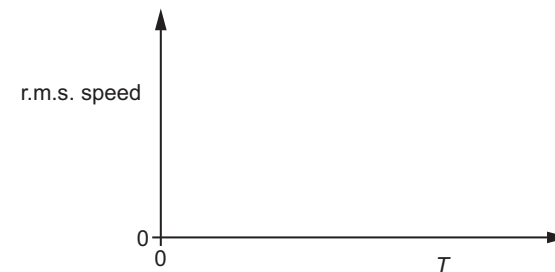


Fig. 4.1

[2]

[Total: 8]

3 (a) State what is meant by an ideal gas.

.....

.....

..... [2]

(b) An ideal gas at a pressure of $1.6 \times 10^5 \text{ Pa}$ has a density of 1.9 kg m^{-3} .

(i) Show that the root-mean-square (r.m.s.) speed of molecules of this gas is approximately 500 m s^{-1} .

[3]

(ii) One molecule of the gas has a mass of $4.7 \times 10^{-26} \text{ kg}$.

Determine the thermodynamic temperature of the gas.

temperature = K [2]

(c) Calculate the internal energy U of 6.0 mol of the gas in (b). Explain your reasoning.