

- 2 (a) State the basic assumptions of the kinetic theory of gases.

For
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Use

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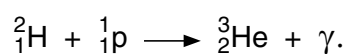
- (b) Use equations for the pressure of an ideal gas to deduce that the average translational kinetic energy $\langle E_K \rangle$ of a molecule of an ideal gas is given by the expression

$$\langle E_K \rangle = \frac{3}{2} \frac{R}{N_A} T$$

where R is the molar gas constant, N_A is the Avogadro constant and T is the thermodynamic temperature of the gas.

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- (c) A deuterium nucleus ${}^2_1\text{H}$ and a proton collide. A nuclear reaction occurs, represented by the equation



- (i) State and explain whether the reaction represents nuclear fission or nuclear fusion.

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- (ii) For the reaction to occur, the minimum total kinetic energy of the deuterium nucleus and the proton is $2.4 \times 10^{-14} \text{ J}$.
Assuming that a sample of a mixture of deuterium nuclei and protons behaves as an ideal gas, calculate the temperature of the sample for this reaction to occur.

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temperature = K [3]

- (iii) Suggest why the assumption made in (ii) may not be valid.

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