

- 6 (a) State the first law of thermodynamics.

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[2]

- (b) The temperature of a sample of ideal gas is raised via two different processes.

In the first process, the ideal gas is heated up with its volume kept constant.

In the second process, the ideal gas is heated up at constant pressure.

The initial and final temperatures of the ideal gas are the same for the two processes.

Using the first law of thermodynamics, explain why the second process requires more heat transfer to the gas than the first.

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[3]

- (c) A car tyre has a fixed internal volume of 0.036 m^3 . The temperature and pressure of the air inside the car tyre are 25°C and $2.6 \times 10^5 \text{ Pa}$, respectively.

Assume that the air inside the tyre can be considered as an ideal gas.

- (i) Determine the number of air particles in the car tyre.

number of air particles = [2]

- (ii) The average molar mass of the air is 6.5 g.

Calculate the root mean square (r.m.s.) speed of the air molecules.

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