

- 4 (a) (i) State what is meant by the *internal energy* of a system.

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..... [1]
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- (ii) Explain why, for an ideal gas, the change in internal energy is directly proportional to the change in thermodynamic temperature of the gas.

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..... [3]
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- (iii) A box, filled with an ideal gas, is rapidly accelerated horizontally from rest.

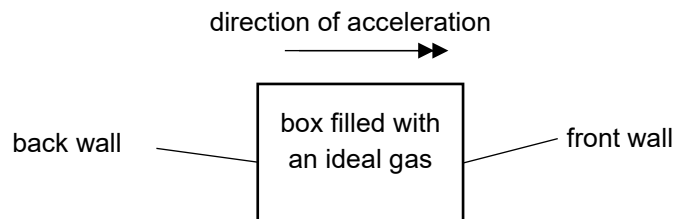


Fig. 4.1

Suggest, with a reason, how the internal energy of the gas would vary from the back wall to the front wall of the box during the acceleration.

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 [2]

- (b) A cylinder of volume $1.8 \times 10^4 \text{ cm}^3$ contains helium gas at pressure $6.4 \times 10^6 \text{ Pa}$ and temperature 25°C . The root-mean-square speed of the helium gas atoms is 336 m s^{-1} . Helium gas may be considered to be an ideal monatomic gas.

(i) Calculate the number of helium atoms in the cylinder.

number = [2]

(ii) Calculate the density of helium atoms in the cylinder.

density = kg m^{-3} [2]

