

2 (a) State the first law of thermodynamics.

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.....
..... [1]

(b) An ideal gas is placed in an insulated cylinder as shown in Fig. 2.1.



Fig 2.1

Initially, its pressure is $1.04 \times 10^5 \text{ Pa}$ and its temperature is 314 K. 28.5 J of heat is then supplied to the gas, causing its volume to increase from $2.90 \times 10^{-4} \text{ m}^3$ to $4.00 \times 10^{-4} \text{ m}^3$ while keeping its pressure constant.

(i) Calculate the work done on the gas.

work done on gas = J [2]

- (ii) Show that the change in internal energy of the gas is 17.1 J.

[1]

- (iii) Calculate the new temperature of the gas.

new temperature = K [2]

- (iv) Calculate the ratio of the final root-mean-square (r.m.s.) speed to the original r.m.s. speed of the molecules.

ratio = [2]

[Total 8]

