2

(a)

(i)

State 2 assumptions that the kinetic theory of gases makes about any ideal gas.

…………………………………………………………………..……..…….…………..

…………………………………………………………...…………..……………

…………………………………………………………………..……..…….…………..

…………………………………………………………...…………..……………

[2]

(ii)

A fixed mass of gas can be compressed into a smaller volume, such as when an inflated balloon is squeezed.

Using the kinetic theory of gases, explain why the pressure exerted by the gas on its container wall increases when its volume is reduced at constant temperature.

……………………………………………………………………..……..……..…………..

……………………………………………………………..…………..……………..

……………………………………………………………………..……..……..…………..

……………………………………………………………..…………..……………..

[2]

(b)

The p – V diagram in Fig. 2.1 shows one cycle of changes applied to a fixed mass of gas in a petrol engine.

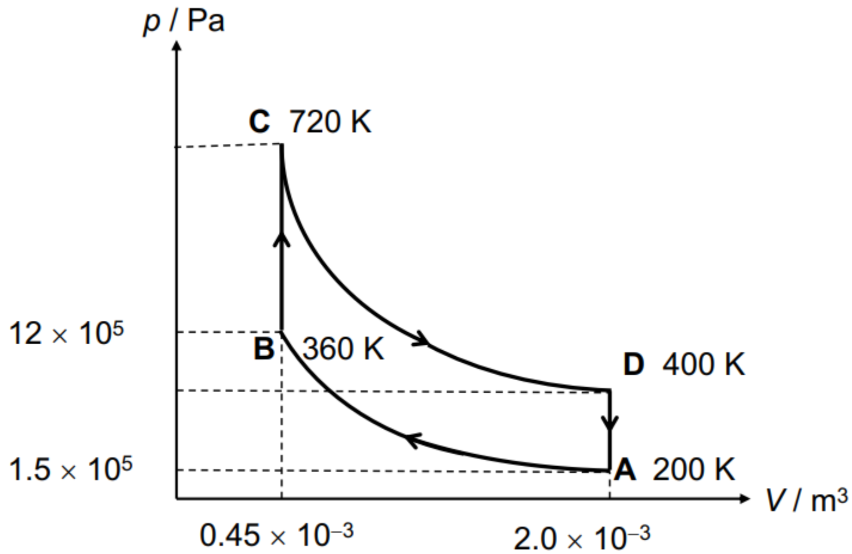

Fig. 2.1

The cycle starts at A with the gas at a volume of 2.0×10^{-3} m^3, temperature of 200 K and pressure of 1.5×10^5 Pa. From A to B, when it is compressed to a volume of 0.45×10^{-3} m^3, the pressure and temperature rises to 12×10^5 Pa and 360 K respectively.

(i)

Assuming that the gas is an ideal gas, determine the number of moles in the fixed mass of gas.

number of moles = ………………….. mol

[1]

(ii)

Given that the mass of one gas molecule is 40u, calculate the r.m.s. speed of the gas molecules at state A.

r.m.s. speed = ………………….. m s^{-1}

[2]

(iii)

From C to D, the gas expands to its original volume and 50 J of heat is lost. The temperature of the gas at D is 400 K. Calculate the work done in this process, stating clearly whether work is done on or by the gas.

work done = ………………….. J

work is done ……………….(on/by) the gas

[3]

[Total: 10]