9 An ideal gas has a volume and mass of 500 cm^3 and 0.23 g respectively, at a pressure of 80 kPa and temperature of 250 K.

(a) The gas is first compressed at a constant pressure, such that the temperature of the gas changes to 180 K.

(i) Determine the work done on the gas.

work done = ... J [3]

(ii) Determine change in the internal energy of the gas.

change in internal energy = ... J [2]

(iii) Determine the heat loss by the gas in the process.

heat loss = ... J [1]

(b) The gas is then heated at constant volume, until the temperature reaches 250 K.

(i) Determine the pressure of the gas at 250 K.

pressure = ... kPa [2]

(ii) Determine the specific heat capacity of the gas at constant volume. Explain your working.

specific heat capacity = ... J kg^{-1} K^{-1} [3]

(iii) Determine the root-mean-square speed of the gas particles after it has been heated to 250 K.

root-mean-square speed = ... m s^{-1} [2]

(iv) State and explain how your answer in **(iii)** would vary if a greater amount of the same gas were to be heated to the same temperature.

....

....

.... [2]

(c) The gas now undergoes an expansion at constant temperature, until the volume of the gas reaches 500 cm^3 and the gas returns to its original state.

In Fig. 9.1, sketch the variation with volume of the pressure of the gas as it undergoes a cycle of the following processes:

(i) compression at constant pressure in **(a),**

(ii) heating at constant volume in **(b)**,

(iii) expansion at constant temperature in **(c)**.

Appropriate numerical values are required on both axes.

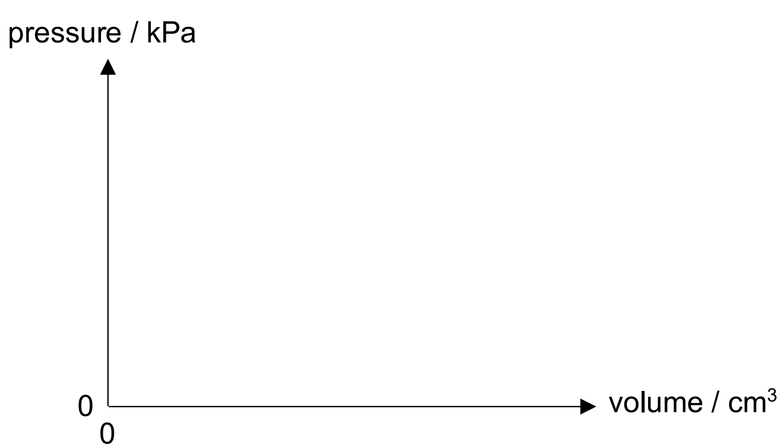

Fig. 9.1

[3]

(c) State and explain whether heat is gained or lost by the gas in one cycle of the processes in **(c)**.

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....

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.... [2]

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