4 **(a)** Explain what is meant by an *ideal gas*.

.....

.....

.....[1]

(b) Two vessels X and Y of volumes 10.0×10^{-4} m^3 and 3.0×10^{-4} m^3 are connected by a tube of negligible volume and kept at temperatures 200 K and 100 K respectively. Assume both vessels contain the same monatomic ideal gas.

Calculate the ratio of $\frac{\text{number of moles of gas in X}}{\text{number of moles of gas in Y}}$.

ratio = ... [2]

(c) An ideal gas in a container with a movable piston is heated. At the same time, the volume is increased such that the temperature of the gas always remains constant. By considering the First Law of Thermodynamics, explain why the temperature of the gas remains constant even though it is heated.

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.....

.....[2]

(d) Fig. 4.1 below shows how the pressure p of the gas varies with its volume V in part **(c)**. The volumes of the gas at initial and final states are V_A and V_B respectively. The pressures of the gas at initial and final are p_A and p_B respectively.

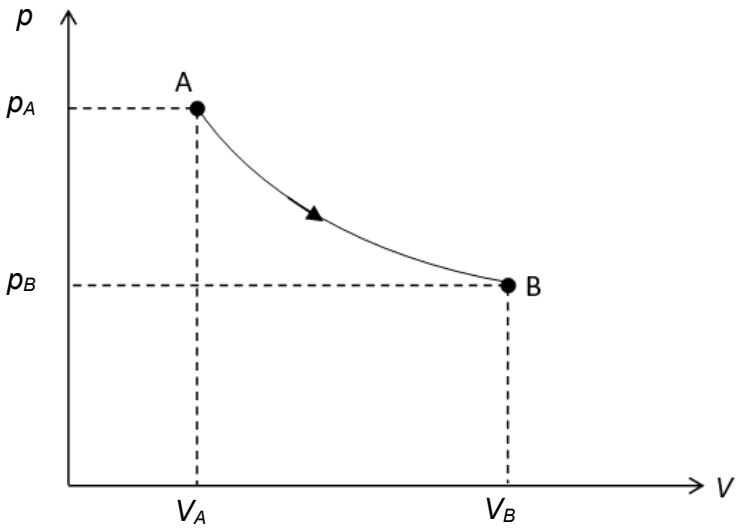

Fig. 4.1

The container in **(c)** is now insulated. The volume of the gas is increased to V_B again.

(i) Use the First law of Thermodynamics to explain whether the final pressure is higher or lower than p_B.

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.....[3]

(ii) Sketch, on Fig. 4.1, a graph to show the variation with volume of pressure of the gas as its volume increases in the insulated container. [1]

[Total: 9]