Section A

Answer **all** the questions in this Section in the spaces provided.

1 **(a)** The microscopic potential energy of an ideal gas is taken to be zero.
State the assumption of an ideal gas that leads to this result.

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.... [1]

(b) Fig. 1.1 shows a sealed thermally insulated container with a smooth and light piston that separates two monatomic ideal gases, gas A and gas B. The piston does not allow gas A and gas B to mix but allows heat transfer between them.

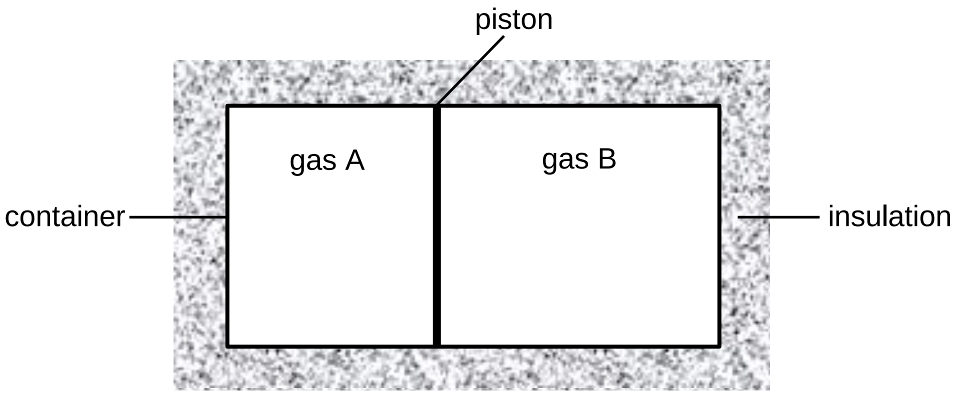

Fig. 1.1

(i) Initially, 1.8 mol of gas A at temperature 400 K and pressure 3.0×10^{5} Pa occupies a volume of 2.0×10^{-2} m^3 while gas B at temperature of 300 K and pressure of 2.0×10^{5} Pa occupies a volume of 3.0×10^{-2} m^3.

1. Show that the amount of gas B is 2.4 mol.

[1]

2. Determine the total internal energy of gas A and gas B.

total internal energy = ... J [2]

(ii) Due to the difference in pressure of the gases, the piston moves until both gases achieve thermal equilibrium and the piston is in translational equilibrium.

1. Calculate the final temperature of the gases. Explain your working.

temperature = ... K [2]

2. Use the first law of thermodynamics to explain the change in the temperature of gas A as the system achieves equilibrium.

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.... [3]

(iii) For the set-up in Fig. 1.1, gas B is now replaced by vacuum. The piston is then removed without any gas escaping or entering the container.

It is found that the final temperature of gas A at equilibrium remains at 400 K, which is the same as its initial temperature.

Explain why there is no change in the temperature of gas A.

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.... [1]