15. Ideal Gases

15.1 The mole

Paper 4

Question Paper

1 (a) (i) State what is meant by the Avogadro constant.

.....

.....

..... [1]

2 **(c)** Fig. 4.1 shows the variation with thermodynamic temperature T of the mean-square speeds $\langle c^2 \rangle$ for two gases X and Y.

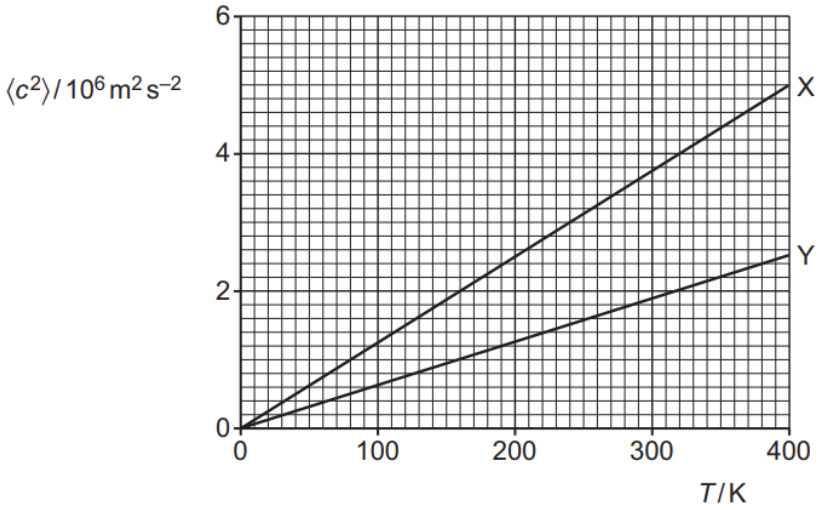


Fig. 4.1

Fig. 4.2 shows the variation with T of the product pV for samples of the two gases, where p is the pressure of the gas and V is the volume of the gas.

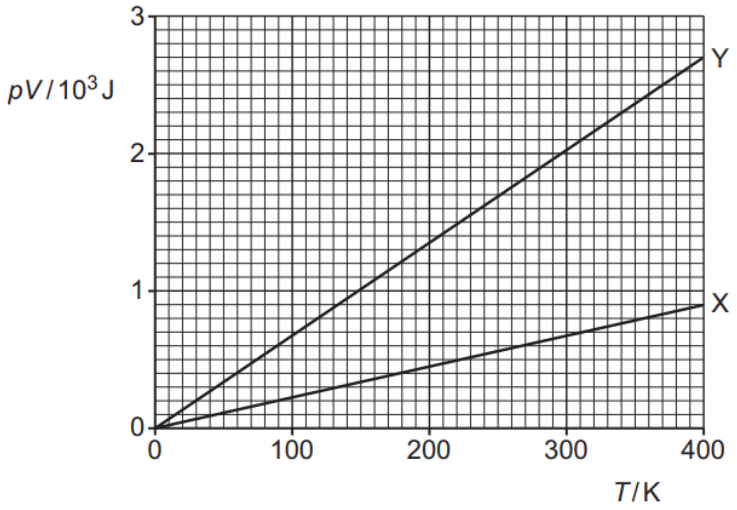


Fig. 4.2

State **three** conclusions about the gases and their samples that may be drawn from Fig. 4.1 and Fig. 4.2. The conclusions may be qualitative or quantitative. Use the space below for any working that you need.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

3 **(b)** A sealed vessel contains a mass of 0.0424 kg of an ideal gas at 227 °C.
The pressure of the gas is 1.37×10^5 Pa and the volume of the gas is 0.640 m^3.

Calculate:

(ii) the mass of one molecule of the gas

mass = ... kg [1]

4 **(b)** An ideal gas comprised of single atoms is contained in a cylinder and has a volume of $1.84 \times 10^{-2}\,m^3$ at a pressure of $2.12 \times 10^{7}\,Pa$.
The mass of gas in the cylinder is 3.20 kg.

(ii) The temperature of the gas in the cylinder is 22 °C.

Determine, to three significant figures,

1. the amount, in mol, of the gas,

amount = ... mol [2]

2. the mass of one atom of the gas.

mass = ... kg [2]

(c) Use your answer in **(b)(ii) part 2** to determine the nucleon number A of an atom of the gas.

A = ... [1]