7 **(a)** Radium-226 ($^{226}_{88}Ra$) decays by alpha emission to form radon (Rn).
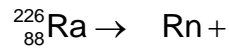
Complete the nuclear equation for the decay.

$$^{226}_{88}Ra \rightarrow \quad Rn +$$

[1]

(b) Radium-226 has a half life of 1600 years.

Show that the activity of a sample of pure radium-226 can be considered to be constant over a period of 6.0 days.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

……………………………………………………………………………………………….. [2]

(c) An experiment was carried out to measure the amount of alpha particles produced by radium-226. A sample of pure radium-226 was placed in a small cylinder A, which was fixed in the centre of a larger cylinder B as shown in Fig. 7.1.
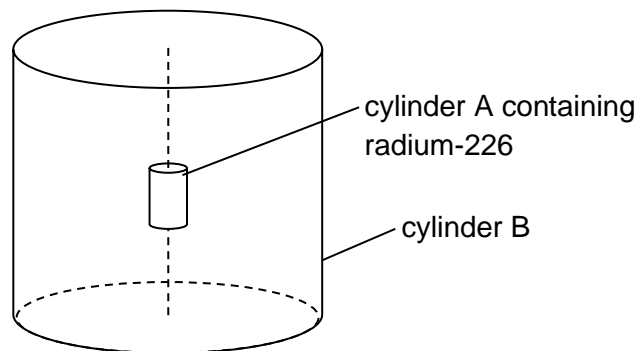

cylinder A containing radium-226

cylinder B

Fig. 7.1

As the alpha particles pass through the wall of cylinder A, they combine with electrons and are trapped inside cylinder B as helium gas atoms.

(i) Explain why the wall of cylinder A must be made of very thin glass.

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

…………………………………..……………………………………………………… [1]

(ii) After a period of 6.0 days, the pressure inside cylinder B was found to increase by 0.82 Pa. The volume of cylinder B was 1.5×10^{-5} m^3 and the volume of cylinder A was negligible. The experiment was conducted at a temperature of 25 °C.

Calculate the number of helium gas atoms which accumulated in cylinder B during the 6.0 day period. Assume that helium gas behaves as an ideal gas.

number of atoms = …………………………… [2]

(iii) Calculate the activity of the sample of radium-226 during the experiment.

activity = …………………………… Bq [2]

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