(b) During the time for which the charge is moving, 1.1×10^5 J of energy is dissipated in the 45 Ω resistor.

(i) Determine the energy dissipated in the 15 Ω resistor during the same time.

energy = ... J

(ii) Suggest why the total energy provided is greater than that dissipated in the two resistors.

.....

.....

[4]

8 A nucleus of an atom of francium (Fr) contains 87 protons and 133 neutrons.

(a) Write down the notation for this nuclide.

.....
Fr
..... [2]

(b) The nucleus decays by the emission of an α-particle to become a nucleus of astatine (At).

Write down a nuclear equation to represent this decay. [2]

9 The radiation from a radioactive source is detected using the apparatus illustrated in Fig. 9.1.

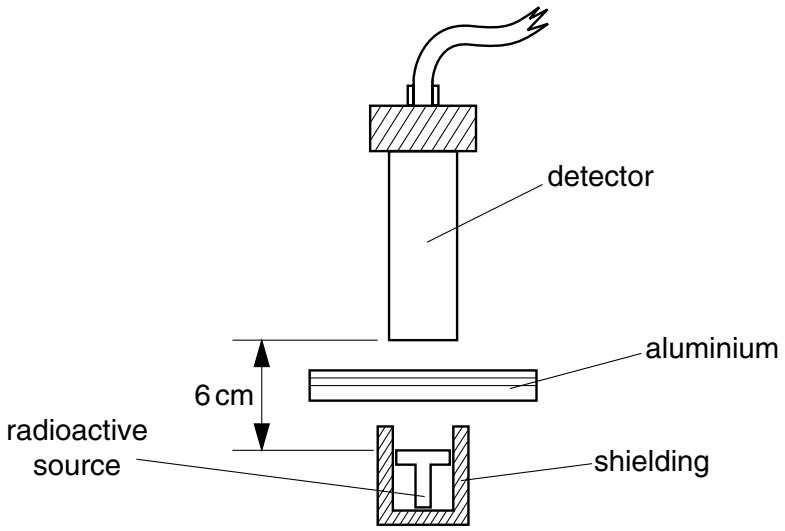

Fig. 9.1

Different thicknesses of aluminium are placed between the source and the detector. The count rate is obtained for each thickness. Fig. 9.2 shows the variation with thickness *x* of aluminium of the count rate.

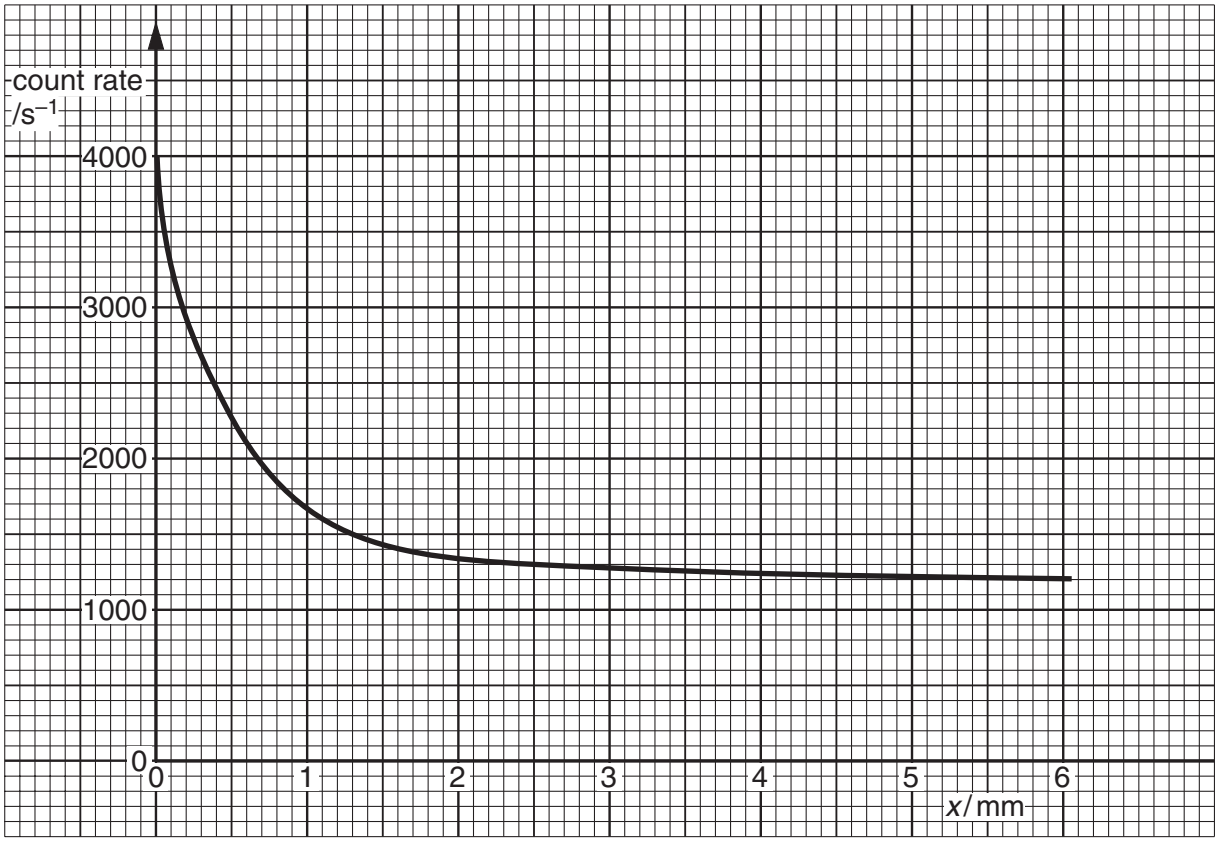

Fig. 9.2

5 **(a)** In the following list of solids, underline those materials which are crystalline.

rubber copper nylon glass aluminium [2]

(b) The three graphs A, B and C of Fig. 5.1 represent the variation with extension *x* of the tension *F* in specimens of three different materials. One of the materials is polymeric, one is brittle and the other is ductile. They are not shown in that order in Fig. 5.1.

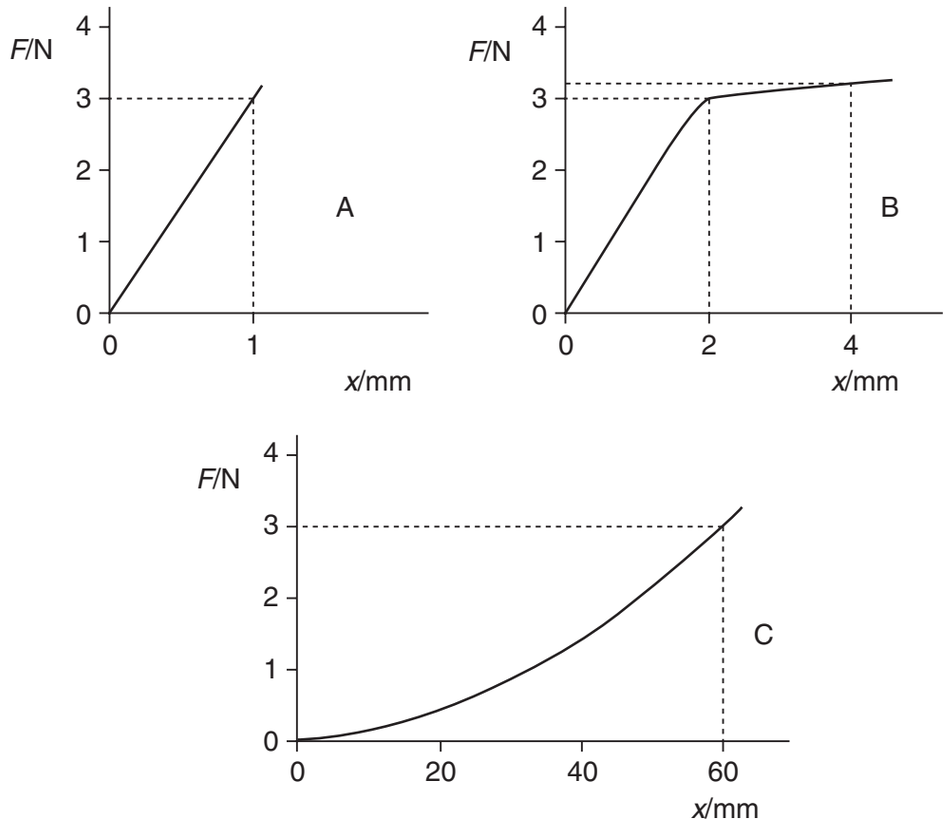

Fig. 5.1

(i) State the type of material which would produce the line shown in each graph.

Graph A is for a ..... material.

Graph B is for a ..... material.

Graph C is for a ..... material. [2]

(ii) Use graph B to estimate the work done in stretching the specimen from 0 to 4 mm.

work done = ... J [3]

[Turn over

8 **(a)** One isotope of gold is represented as

$$^{197}_{79}\text{Au}.$$

State the number of neutrons in one nucleus of this isotope.

number = ... [1]

(b) In an α-particle scattering experiment, an α-particle approaches an isolated gold nucleus, as illustrated in Fig. 8.1.

Fig. 8.1

Complete Fig. 8.1 to show the path of the α-particle as it passes by, and moves away from, the gold nucleus. [2]

(c) The α-particle in **(b)** is replaced by one having greater initial kinetic energy.

State what change, if any, will occur in the final deviation of the α-particle.

.....[1]