

- 7 Many radioisotopes have important industrial, medical and research applications. One of these is  $^{60}\text{Co}$ , which has a half-life of 5.2 years and each  $^{60}\text{Co}$  nucleus decays by emission of a beta particle (energy of 0.31 MeV) and two gamma photons (energies of 1.17 MeV and 1.33 MeV respectively).

A scientist wishes to prepare a  $^{60}\text{Co}$  sealed source that will have an activity of at least  $3.7 \times 10^{11}$  Bq after 30 months of use.

- (a) Show that the initial minimum activity of  $^{60}\text{Co}$  when the scientist is preparing the radioisotopes is  $5.2 \times 10^{11}$  Bq

[2]

**(b)** Hence, calculate the minimum initial mass of  $^{60}\text{Co}$  required.

$$\text{minimum initial mass} = \dots \text{g} \quad [3]$$

**(c)** Determine the rate at which the source will emit energy after 30 months.

$$\text{rate of energy emission} = \dots \text{W} \quad [3]$$