放射化学　RADIOCHEMISTRY

1. ^{90}Sr is a radioactive nuclide with a half-life of 30 years (decay constant: 7.4×10^{-10} s^{-1}). It undergoes β^- decay into daughter nuclide. The daughter nuclide of ^{90}Sr also undergoes β^- decay into a stable nuclide with a half-life of 60 hours.

   1.0 mg of ^{90}Sr in a hydrochloric acid solution is isolated from the daughter nuclide at $t = 0$.

   Answer the following questions. In these questions, use the given half lives and approximate values, *i.e.*, $\log_e 2 = 0.70$ and Avogadro's number $N_A = 6.0 \times 10^{23}$ mol^{-1}. The significant figure is 2 digits. 【Radioactive decay】【Radioactive equilibrium】【Separation in radiochemistry】

   (1) Calculate activity [Bq] of ^{90}Sr in the hydrochloric acid solution at $t = 0$.

   (2) Show the daughter nuclide of ^{90}Sr. And show a coprecipitation reaction to collect the daughter nuclide in precipitation by a reaction formula.

   (3) Calculate total activity [Bq] in the hydrochloric acid solution after 60 years (at $t = 60$ y).

2. A solution containing 5×10^3 Bq/mL of a radioactive nuclide with a half-life of 2 minutes was prepared. 0.1 mL of this solution was injected to a rabbit by intravenous injection. 6 minutes later, 1.0 mL of blood was sampled from the rabbit, and then, the activity of the blood sample was determined to be 0.25 Bq. Calculate total blood volume [mL] of this rabbit.

   The radioactive nuclide was uniformly spread over the blood right after the injection, and did not migrate to other tissues.

   【Detection and measurement of radioactivity】
   【Isotope dilution analysis・Age determination from radioactive decay】