

Radiation Biology, Protection and Applications

(PHYS-450)

**PRACTICE EXERCISES**

Week 08

**Problem 1:**

How many alpha and beta particles are emitted by a nucleus of an atom of the uranium series, which starts as  ${}^{238}_{92}\text{U}$  and ends as stable  ${}^{206}_{82}\text{Pb}$ ?

**Problem 2:**

A typical smoke detector contains a  ${}^{241}\text{Am}$  source with an activity of 30 kBq. What is the mass of the  ${}^{241}\text{Am}$ ? ( $T_{1/2}=432.2\text{years}$ )

**Problem 3:**

When will 5 GBq of  ${}^{131}_{53}\text{I}$  ( $T_{1/2} = 8.05 \text{ days}$ ) and 2 GBq of  ${}^{32}_{15}\text{P}$  ( $T_{1/2} = 14.3 \text{ days}$ ) have equal activities?

**Problem 4:**

A solution with a radioisotope  ${}^{24}\text{Na}$  of activity  $A_0 = 2 \text{ kBq}$  was injected into the blood of a person. Volume activity  $a_v$  of the blood was measured 5 hours after the injection and it was determined to be  $265 \text{ kBq/m}^3$ . Determine the volume of the person's blood in liters. The half-life of  ${}^{24}\text{Na}$  is 15 hours.

**Problem 5:**

What was the age of the rock sample acquired during the Apollo 17 mission in 1972, if the isotopic ratio  ${}^{87}_{38}\text{Sr}/{}^{87}_{37}\text{Rb}$  was found to be 0.065? The decay reaction can be expressed as follows:  ${}^{87}_{37}\text{Rb} \rightarrow {}^{87}_{38}\text{Sr} + {}^0_{-1}\beta$ ;  $T_{1/2} = 4.7 \times 10^{10} \text{ years}$ .