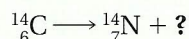
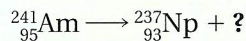


their lifetime. After death, no more carbon-14 is taken in, so the amount gradually decreases due to decay:



- b. This decay process takes place in some types of household smoke detectors:



2. Thorium (Th) occurs in nature as three isotopes: Th-232, Th-230, and Th-228. The first of these is the most abundant. The radiation intensity of thorium is quite low. In fact, its compounds can be used without great danger if kept outside the body. Thorium oxide (ThO_2) was widely used for gas lights in mantles in Europe and America during the gas-lighting era and more recently in outdoor camping lanterns, producing the surface that glows brilliant white as the fuel burns.

Th-232 is the parent isotope of the third natural decay series. This series and the U-238 series are believed to be responsible for much of the thermal energy generated inside Earth. (The thermal contribution from the U-235 series is negligible, since the natural abundance of U-235 is quite low.)

Complete these equations, which represent the first five steps in the Th-232 decay series. Identify the missing items A, B, C, D, and E. Each code letter represents a particular isotope or a type of radioactive emission. For example, in the first equation, Th-232 decays by emitting alpha radiation to form "A." What is A?

- a. $^{232}_{90}\text{Th} \longrightarrow ^4_2\alpha + \text{A}$ d. $\text{D} \longrightarrow ^4_2\text{He} + ^{224}_{88}\text{Ra}$
 b. $^{228}_{88}\text{Ra} \longrightarrow ^0_{-1}\text{e} + \text{B}$ e. $^{224}_{88}\text{Ra} \longrightarrow \text{E} + ^{220}_{86}\text{Rn}$
 c. $^{228}_{89}\text{Ac} \longrightarrow \text{C} + ^{228}_{90}\text{Th}$

An alpha particle can be symbolized either as ^4_2He or $^4_2\alpha$.

B.6 RADON

The gaseous element radon (Rn)—the most massive of the noble gases—has always been a component of Earth's atmosphere. It is a radioactive decay product of uranium. In the 1980s, unusually high concentrations of radioactive radon gas in a relatively small number of U.S. homes became a public health concern.

Radon is produced as uranium-238 radioactively decays in the soil and in building materials. Some radon produced in the soil dissolves in groundwater. Houses may have cracks in their foundations and basement floors that permit radon gas to seep into them. In older homes, outdoor air enters through doors, windows, and the gaps around them and thus dilutes the radon or removes it from the house. However, to conserve energy, new

You can locate this radioactive decay product as Rn-222 in the decay series chart shown in Figure 25.