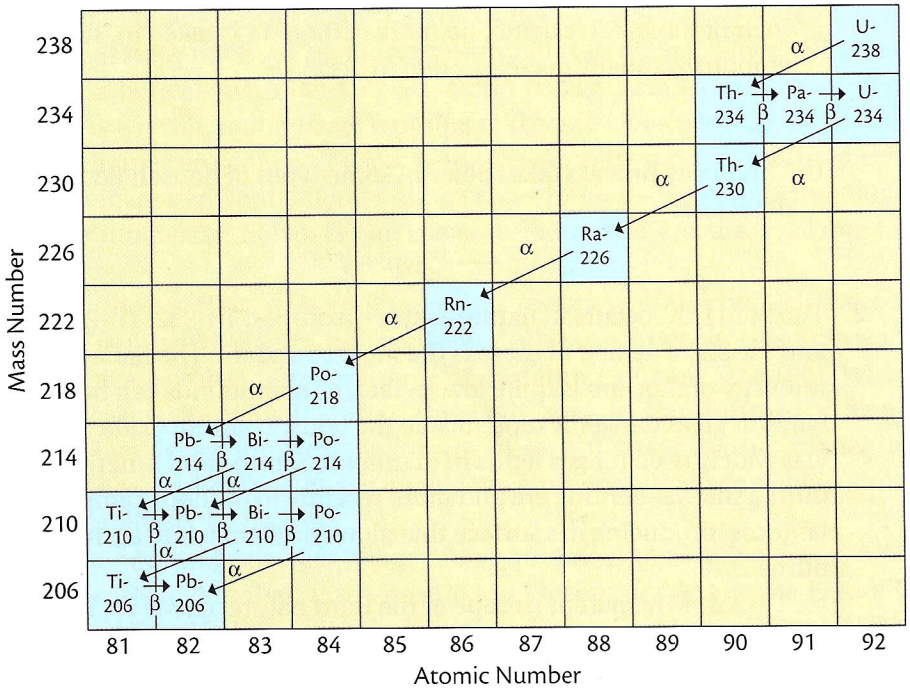

Figure 25 *The uranium-238 decay series. Diagonal lines show alpha decay, horizontal lines show beta decay. Here is how to read the chart: Locate radon-222 (Rn-222). The arrow to the left shows that this isotope decays to polonium-218 by alpha (α) emission. This nuclear equation applies:*

$$^{222}_{86}Rn \rightarrow {}^{218}_{84}Po + {}^{4}_{2}He$$

with U-238, U-235, and Th-232, respectively. Each decay series ends with the formation of a stable isotope of lead (Pb). The decay series starting with uranium-238 contains 14 steps, as shown in Figure 25.

NUCLEAR BALANCING ACT

Building Skills 3

The key to balancing nuclear equations is recognizing that both atomic numbers and mass numbers are conserved. Use information in Figure 23 to complete the following exercise.

Cobalt-60 is a common source of ionizing radiation for medical therapy. Complete this equation for the beta decay of cobalt-60:

$$^{60}_{27}Co \longrightarrow {}^{0}_{-1}e + \mathbf{?}$$

Beta emission causes no change in mass number, as noted in Figure 23. Therefore, the new isotope will also have mass number 60. Thus the unknown product can be written as ^{60}**?**. Because the atomic number increases by one during beta emission, the new isotope will have atomic number 28, one more than cobalt. The periodic table indicates that the element with atomic number 28 is Ni, nickel. The final equation is

$$^{60}_{27}Co \longrightarrow {}^{0}_{-1}e + {}^{60}_{28}Ni$$

1. Write the appropriate symbol for the type of radiation given off in each of these reactions:
   a. The decay process shown below allows archaeologists to date the remains of ancient biological materials. Living organisms take in carbon-14 and maintain a relatively constant amount of it over