

NAME:

HONORS CHEMISTRY

SECTION:

Radioactive Dating Problems

Level 1

1. Gold-198 has a half-life of 2.70 days. If a 225 gram sample of gold-198 disintegrates over the course of 10.8 days, what mass of gold-198 remains?

2. What is the half-life of a radioactive isotope if a 325 g sample decays to 10.2 g in 26.3 years?

3. The half-life of potassium-42 is 12.4 hours. What mass of a 850. gram sample remains after 62.0 hours?

4. What is the half-life of neon-19, if a 500. milligram sample decays to 62.5 milligrams in 51.6 seconds?

5. The half-life of thorium-232 is 1.4×10^{10} years. If there are 15.0 grams of thorium-232 left after 2.8×10^{10} years, how many grams of radioactive nuclide were in the original sample?

6. There are 7.0 g of iron-53 left after 135 days. How many grams were in the original sample if iron-59 has a half life of 45.1 days? Iron-59 is used as a radiotracer to study red blood cells.

Level 2—Challenge Problems

$$y = \frac{1}{2^n} \quad \text{where } y = \text{fraction of original material and} \\ n = \text{number of half-lives elapsed}$$

$$A_t = A_o e^{kt} \quad \text{where } k = \frac{-\ln(2)}{T_{1/2}} \quad \text{and}$$

$T_{1/2}$ = the time required for 50% of the original sample to decay

7. Phosphorus-32 is a commonly used radioactive nuclide in biochemical research, particularly in studies of nucleic acids. The half-life of phosphorus-32 is 14.3 days. What mass of phosphorus-32 is left of an original sample of 175 mg after 35.0 days?
8. Strontium-87 is used as a radiotracer to assess bone abnormalities, as it has similar chemical properties to calcium. How long does it take for 10.0% of a sample of strontium-87 to decay? The half-life of strontium-87 is 2.8 hours.
9. Xenon-133 is used as a radiotracer to study function of the lungs. If a sample of xenon-133 with an initial mass of 1.2 mg decays to a mass of 0.47 mg in 7.2 days, calculate the half-life of xenon-133.
10. Iodine-131 is used in the treatment of tumors in the thyroid gland. Its half-life is 8.07 days. Suppose that, due to a shipment delay, the I-131 in the hospital's pharmacy is 2.0 days old.
 - a. What percentage of the I-131 has decayed?
 - b. A patient is scheduled to receive 15.0 mg of I-131. What dosage, in milligrams, should the pharmacist recommend for this patient if the 2.0 day-old bottle is used?