Half-life Questions and Answers

1. How long will 500 grams of strontium-90 take to decay to 125 grams? (Half-life of strontium-90 = 28.8 years)

2. How many half-lives will it take 50 grams of technetium-99 to decay to 6.25 grams? (Half-life of technetium-99 = 211,000 years)

3. After 9.8×10^{10} years, how much of a 256 gram-sample of thorium-232 will be left? (Half-life of thorium-232 = 14 billion years)

4. If 50 grams of a cobalt-60 sample are left after 15.8 years, how much did the original sample weigh? (Half-life of cobalt-60 = 5.26 years)

5. How long will a 28-gram sample of radium-226 take to decay to 3.5 grams? (Half-life of radium-226 = 1600 years)

6. If 25 grams of iodine-131 are left after 40.35 days, how many grams were in the original? (Half-life of iodine-131 = 8.07 days)

Half-life Questions and Answers

Answers

1. How long will 500 grams of strontium-90 take to decay to 125 grams? (Half-life of strontium-90 = 28.8 years)

   56.2 years

   For 500 grams of strontium-90 to decay to 125 grams, it must pass through 2 half-lives (500 x ½ = 250 x ½ = 125). So, the time taken by strontium-90 to decay to 125 grams = 2 x 28.8 = 56.2 years.

2. How many half-lives will it take 50 grams of technetium-99 to decay to 6.25 grams? (Half-life of technetium-99 = 211,000 years)

   3 half-lives

   For 50 grams of technetium-99 to decay to 6.25 grams, it passes through 3 half-lives (50 x ½ = 25 x ½ = 12.5 x ½ = 6.25).

3. After 9.8×10^{10} years, how much of a 256 gram-sample of thorium-232 will be left? (Half-life of thorium-232 = 14 billion years)

   2 grams

   After 9.8×10^{10} years, thorium-232 has passed through 7 half-lives ($9.8 \times 10^{10} / 1.4 \times 10^{10} = 7$). So the amount of the sample of thorium-232 left will be = $256 \times (½)^7 = 2$ grams.

4. If 50 grams of a cobalt-60 sample are left after 15.8 years, how much did the original sample weigh? (Half-life of cobalt-60 = 5.26 years)

   400 grams

   The sample passed through 3 half-lives (15.8/5.26 = 3). So, the weight of the original sample is $2^3 \times 50 = 8 \times 50 = 400$ grams.

5. How long will a 28-gram sample of radium-226 take to decay to 3.5 grams? (Half-life of radium-226 = 1600 years)

   4800 years

   For 28 grams of radium-226 to decay to 3.5 grams, it passes through 3 half-lives (28/3.5 = 8 = 2^3). So, the time taken for radium-226 to decay to 3.5 grams = 3 x 1600 years = 4800 years

6. If 25 grams of iodine-131 are left after 40.35 days, how many grams were in the original? (Half-life of iodine-131 = 8.07 days)

   800 grams

   After 40.35 days, the sample has passed through 5 half-lives. So, the weight of the original sample is = $2^5 \times 25 = 800$ grams