

EXAMPLES OF NUMERICAL PROBLEMS INVOLVING RADIOACTIVE DECAY

1. ^{137}Cs has a half-life of 30.17 years. Is it a suitable radioactive isotope for dating 5000 year old artifacts? Justify your answer mathematically. [A: after 5000 years there is $\sim 10^{-50}$ of the original isotope left, which means all of the isotope decayed and that makes it entirely unsuitable.]
2. Find the mass of a radioactive isotope after 3 half lifes. The initial mass of the isotope was 80 grams. [A: 10 grams]
3. The initial mass of iodine isotope is 200 grams. Determine the iodine mass after 30 days if the half life of the isotope is 8 days. [A: 14.9 grams]
4. The radioactive isotope Indium-111 is often used for diagnosis and imaging in nuclear medicine. Its half life is 2.8 days. What was the initial mass of the isotope before decay if the mass in 2 weeks was 5 grams? [A: 160 grams]
5. Find a half life of a radioactive element if its activity decreases by 10% in 1 month. [A: 197.3 days]
6. Over the past few years, the number of students enrolled at a certain university has been decreasing. Each year there is a 12% decrease student enrollment. Currently, 14,286 students are enrolled. If this trend continues, how many students will be enrolled in 5 years? [A: 7,539 students]
7. Scientists recently discovered a new type of metal compound. They have roughly 15 grams of this compound, which has a half life of 16 hours. Approximately how much of this substance will the scientists have after 24 hours? [A: 5.3 grams]
8. The number of fish in an aquarium today is 1500. In 4 years the number of fish will be 1122. If the number of fish is decreasing with exponential decay, what is the half life of the fish population? What annual percent decrease does that correspond to? [A: 9.55 years; 7%.]

9. Cells in a dish have started to decay. The cells are decaying by 3% every 20 minutes. When you left the cells there were 1000 cells in the dish. Now there are 92 cells in the dish. Approximately how long did you leave the cells for? [A: 26 hours 6 minutes]