**Half-life Problems**

![C:\Documents and Settings\kkelley\Local Settings\Temporary Internet Files\Content.IE5\I00G7SPA\MC900287501[1].wmf]()The half-life of a radioactive substance **is the time it takes for half of the material to decay**. You are encouraged to make a table in order to generate some of the data for each problem situation below. Solve the following half-life problems by writing an equation and using the equation to find the solution. Make sure you find the initial value for each equation. The first problem has been partially worked in order to help you with the remaining problems.

1. A hospital prepared a 100-mg supply of technetium-99m, which has a half-life of 6 hours. Use the table below to help you understand how much of technetium-99m is left at the end of each 6-hour interval for 36 hours. Use this to help write an exponential function to find the amount of technetium-99m that remains after 75 hours.

The amount of technetium-99m is reduced by one half each 6 hours as shown in the table below. Fill in the missing information in the table and in the equation below.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Number of 6-hour Intervals** | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| **Number of Hours Elapsed** | 0 | 6 |  | 18 | 24 |  | 36 |
| **Amount of Technetium-99m (mg)** | 100 | 50 | 25 |  |  | 3.13 |  |

The amount of technetium-99m is an exponential function of the number of half-lives. The initial amount is \_\_\_\_ mg. The decay factor is \_\_\_\_. One half-life equals 6 hours.

Write an explicit equation if x = the number of 6-hour intervals. Y = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

That’s getting really easy to do now! But…what if x = the number of hours elapsed. It would be easier to plug in the number of hours instead of how many “6-hour intervals”, but we would have to change the equation a little.

If x = the number of hours elapsed, then the number of 6- hour intervals (of half-lives) =.

Equation:

Use your equation to find the solution to the question.

 🡪 HINT: When you use rational exponents in your calculator, put ( ) around them!

After 75 hours, about \_\_\_\_\_\_\_\_\_\_ mg of technetium-99 remains.

Use a similar format in order to find the equations and solutions of the 4 remaining problems.

1. Arsenic-74 is used to locate brain tumors. It has a half-life of 17.5 days. Write an exponential decay function for a 90-gram sample. Use the function to find the amount remaining after 6 days. (Hint: Make a table to help you understand the data.)
2. Phospohorus-32 is used to study a plant’s use of fertilizer. It has a half-life of 14.3 days. Write the exponential decay function of a 50-mg sample. Find the amount of phosphorus-32 remaining after 84 days.
3. Iodine-131 is used to find leaks in water pipes. It has a half-life of 8.14 days. Write the exponential decay function for a 200-mg sample. Find the amount of iodine-131 remaining after 72 days.
4. Some radioactive ore which weighed 20 grams 200 years ago has been reduced to 12 grams today.
	1. Use exponential regression on your calculator to write an exponential decay function in order to find the solution.
	2. Based on your equation, what is the half-life of this radioactive ore?
	3. Based on your half-life, write another exponential equation for the data in which the base of the exponent is ½ .
	4. How much will be left in 400 years?

Adapted from Prentice-Hall Mathematics Algebra 2, Pearson Education, Inc., Upper Saddle River, NJ, 2004.