

Neutron Activation and Radioactive Decay Worksheet

Virtual Lab: Investigation of an element's half-life

The half-life is the amount of time it takes for half of the atoms of a radioactive material to decay. On the Website there are five experiments for you to choose from.

Step 1: Watch the video of the background radiation measurement on the Website.

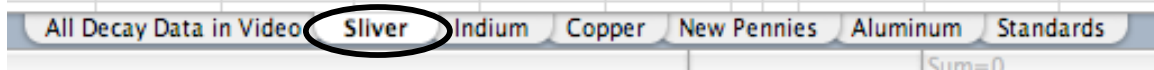
Step 2: With your team, decide on which element half-life you wish to investigate. Sample choices are Silver, Aluminum, Copper, Indium, or “New Pennies”.

a. Our team will investigate

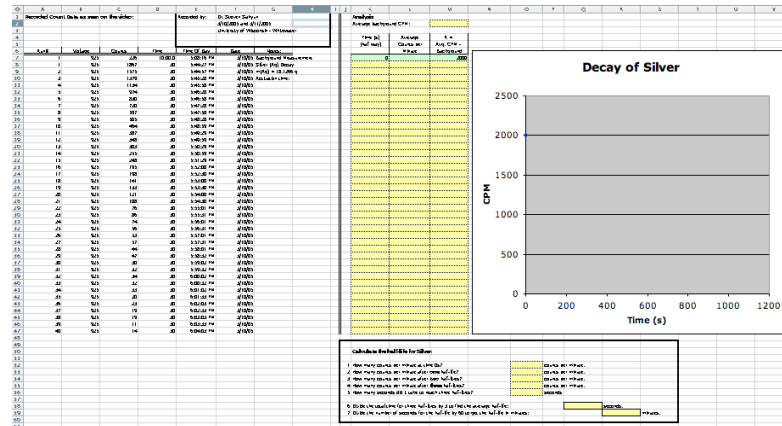
b. Watch the experiment on the Website.

Step 3: Open the “Student Decay Data Simple.xls” file in the spreadsheet program Excel. This file contains the data that you saw recorded in the video.

Step 4: Choose your element from the tabbed list at the bottom of the Excel page:



Step 5: In the “Analysis” area of the worksheet, you will complete the sections in yellow. The computer spreadsheet page section that you will work with looks similar to this:



Step 5: In cell C7 you will find the background counts for your element.

a. The total number of counts recorded in 10 minutes is:

b. The average counts per minute for the background radiation is:

c. Type this result into cell M2.

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Step 6: Use the data in column C to determine the values in the Time, Average CPM, and R columns (the yellow sections) and to calculate the half-life at the bottom.

- a. The first yellow column represents the elapsed counting time. You will need to determine the time for each cell. Fill in the time that occurred in the middle of that observation. Continue to enter time data in each successive cell in the column by adding the recorded time to the previous cell.

For example, suppose each run is 30 seconds (Time cell D8 is 30) and 5000 counts were collected from 0 to 30 seconds. The value placed in the first time cell is 15 (seconds) because that is the middle of the initial observation time. The next time cell is the value in the initial cell (K8) plus the time of the counting run (in this case 30 seconds) so the value in cell K9 is 45 seconds (because $15 + 30 = 45$). The value in the third cell (K10) is that of the previous cell (K9) plus the time of the counting run. This equals 75 seconds (because $45 + 30 = 75$.) Continue this process to the bottom of column's yellow section. Note: The indium sample has extra time between counting runs, so that time must also be factored into your total count time.

- b. In the counts per minute column (CPM) fill in the counts per minute that occurred during the time. Note that not all data were collected in one minute time sets. In the above example, if 5000 counts were collected in 30 seconds, twice that amount (10,000 counts) would have been collected if the observation time were 60 seconds, so the CPM would be 10000.
- c. In the "R = CPM – background" column, subtract the background value that you typed in cell M2 from your counts per minute value (in column L).

As you fill in the cells on the computer, data points will appear in the chart.

Step 7: Complete the questions at the bottom of the Excel page to find your element's half-life.

Step 8: Answer the following questions with the information recorded in your chart.

a. How many half-lives does your graph show?

b. What is the total time for those half-lives to occur?

Conclusion:

- a. We determined the half-life of _____ to be _____ seconds.
- b. Complete the following sentence: The meaning of this half-life is