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Nuclear decay

Objective

In this lab we investigate the nuclear decays and the rate at which nuclear materials decay.

Introduction

Any nucleolus radiates, some radiate more because are unstable and have to give away their energy to become more stable, these can be radiated in forms of alpha decay (positive charges), beta decay or gamma decay.

Experimental Procedure

There are different ways to demonstrate this, we can stimulate this with any tool which represents some randomness such as a flipping a coin which results in a fifty, fifty chance. In this lab we use a java program to simulate this by giving the program the initial number of atoms (1000), we put the probability of the decay to be 0.1

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input P, the probability of decay for A to B.
0.1
input P, the probability of decay for B to C.
0.1
10000 0 0 9004 996 0 8085 1823 92 7275 2464 261 6560 2913 527 5893 3319 788 5283
 3611 1106 4773 3767 1460 4322 3823 1855 3868 3884 2248 3508 3861 2631 3144 3861
 2995 2818 3818 3364 2547 3674 3779 2292 3601 4107 2071 3481 4448 1855 3335 4810
 1675 3202 5123 1525 3026 5449 1381 2873 5746 1258 2714 6028 1139 2558 6303 1020
 2420 6560 911 2302 6787 820 2169 7011 745 2050 7205 660 1942 7398 595 1819 7586
 531 1714 7755 473 1595 7932 432 1478 8090 391 1371 8238 360 1258 8382 321 1184
8495 282 1094 8624 254 1015 8731 222 940 8838 190 879 8931 159 822 9019 146 752
9102 130 691 9179 118 635 9247 105 588 9307 89 539 9372 80 488 9432 69 455 9476
64 414 9522 61 380 9559 53 346 9601 46 309 9645 44 286 9670 37 264 9699 33 239 9
728 31 218 9751 29 199 9772 28 174 9798 23 169 9808 18 162 9820 17 149 9834 16 1
31 9853 13 124 9863 13 115 9872 11 108 9881 9 99 9892 8 87 9905 6 85 9909 6 72 9
922 6 66 9928 5 58 9937 5 55 9940 4 49 9947 3 50 9947 2 49 9949 2 42 9956 2 36 9
962 1 35 9964 1 30 9969 1 28 9971 1 28 9971 1 25 9974 0 23 9977 0 20 9980 0 18 9
982 0 17 9983 0 17 9983 0 16 9984 0 15 9985 0 12 9988 0 10 9990 0 10 9990 0 9 99
91 0 9 9991 0 9 9991 0 9 9991 0 7 9993 0 5 9995 0 5 9995 0 5 9995 0 5 9995 0 3 9
997 0 2 9998 0 1 9999 0 1 9999 0 1 9999 0 1 9999 0 1 9999 0 1 9999 0 1 9999 0 1
9999 0 1 9999 0 1 9999 0 1 9999 0 1 9999
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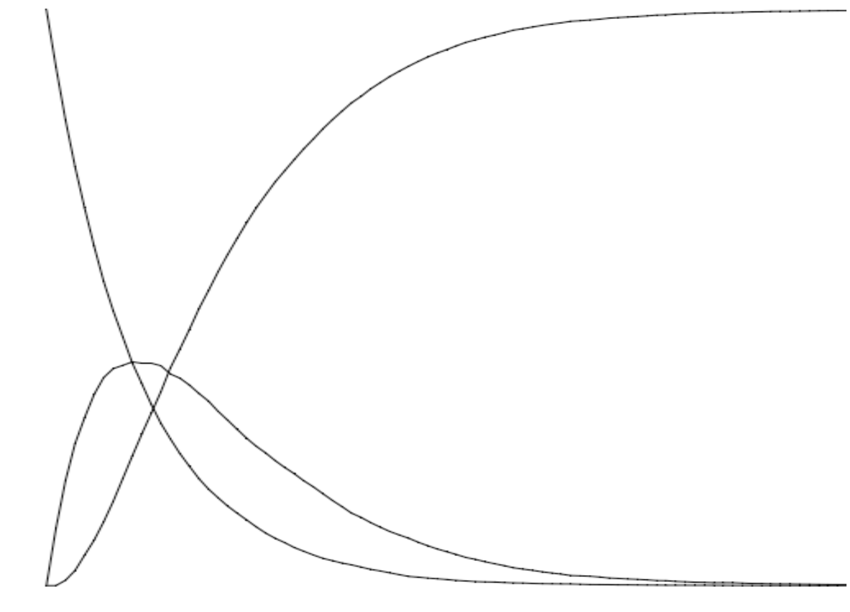

Using the program we can get a graph which looks like an exponential rate that tell us about the rate of decay.

Discussion

The nuclear decay half life graph presented above corresponds to the following equation below.

$$\boldsymbol{N = N_0 e^{-\lambda t}}$$

Half life is the time that it takes for half of atoms to decay and we can show it mathematically:

$$\frac{N}{N_0} = e^{-\lambda t} \rightarrow -\lambda t = \ln\frac{1}{2} \rightarrow t = {}^{Ln\,2}/_{\lambda}$$

The λ is the exponential decay constant of this equation which corresponds to the probability of decay, that was 0.1 in our programmed example.
The exponential decay constant λ is positively proportional to the chance of an atom to decay, therefore by increasing the λ the time shrinks which means that the life time of the nucleolus decreases. In other words its less stable and decays faster.

Conclusion:

This tells us that the nuclear decay occurs exponentially, it looses energy exponentially to restore its stability, Uranium is an example of a very unstable nuclear material which is used in industry and the reason that its being used are primarily due to its instability and abundance.