Decay Lab

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1 Introduction

Decay constant, proportionality between the size of a population of radioactive atoms and the rate at which the population decreases because of radioactive decay. Suppose N is the size of a population of radioactive atoms at a given time t, and dN is the amount by which the population decreases in time dt; then the rate of change is given by the equation dN/dt = N, where is the decay constant. Integration of this equation yields N = N0et, where N0 is the size of an initial population of radioactive atoms at time t =0 . This shows that the population decays exponentially at a rate that depends on the decay constant. The time required for half of the original population of radioactive atoms to decay is called the half-life.

2 Fomula

$$A = Aoe^{-kt}$$

A is the amount of atoms you start with; k is the constant of growth, and because of this is decay k is always negative that is the reason there is a minus symbol before k. t is the time of half life decay.

$$E = \frac{hc}{\lambda}$$

This equation describe the single photon. In this equation light is considered as a continuous electromagnetic wave. Therefore E is equal the energy of photon.

3 Question

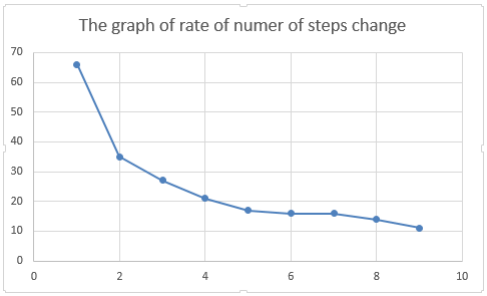
What is the relationship between decay constant and the number of step?

4 First research

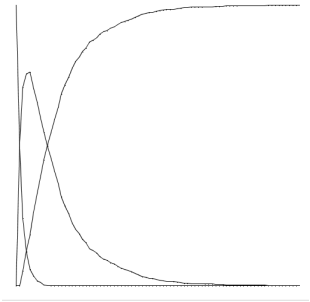
I want to search about the relationship between decay constant A to B and B to C. The amount of atoms is 1000.

	k A to B	k B to C	The number of steps
1	0.5	0.1	66
2	0.5	0.2	35
3	0.5	0.3	27
4	0.5	0.4	21
5	0.5	0.5	17
6	0.5	0.6	16
7	0.5	0.7	16
8	0.5	0.8	14
9	0.5	0.9	11

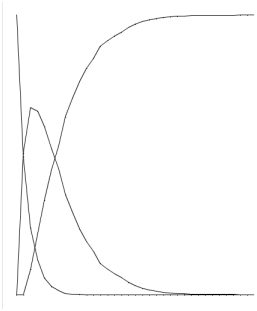
In this table the decay constant which is A decay to B is 0.5 for whole table. In order to get the consequence for this experiment, I only change the decay constant which is B decay to C. And then I find that the rate of change for number of steps is decreasing. The higher decay constant for B to C, the lower rate of change of number of steps which is showed in graph. Therefore we can get result that in same rate of decay from A to B, the more decay rate B to C, the less rate of change of number of steps. And as graph shows the change of number steps is similar as curve for X^{-1}.



Also I found that the maximum of B will be influenced by increasing of decay rate B to C.



1. 488 512 0
2. 240 707 53
3. 120 755 125
4. 59 760 181
5. 34 703 263
6. 17 653 330
7. 12 594 394



1. 493 507 0
2. 240 669 91
3. 125 655 220
4. 61 601 338
5. 30 522 448
6. 16 450 534
7. 5 359 636

The first picture and table are about first lab which have 0.5 A decay rate and 0.1 B decay rate, and the second table and graph are

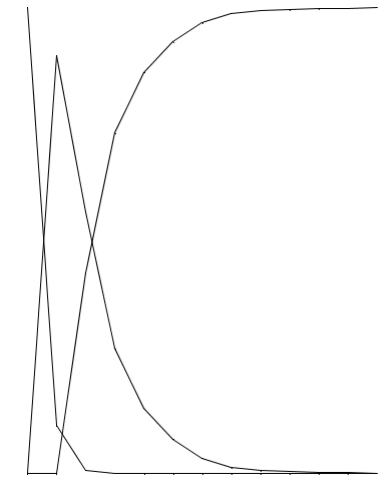
about second lab which have 0.5 A decay rate and 0.2 decay rate. The Both A atoms' decay process finished in 10 steps. And first table shows that fifth step is maximum, but the second table shows that second step is maximum. So that I get result that the more B decay rate, the quicker B reach maximum. Because A atoms both finish their decay process in 10 step, therefore the same A decay rate means the rate of change of number of A atoms is constant or similar.

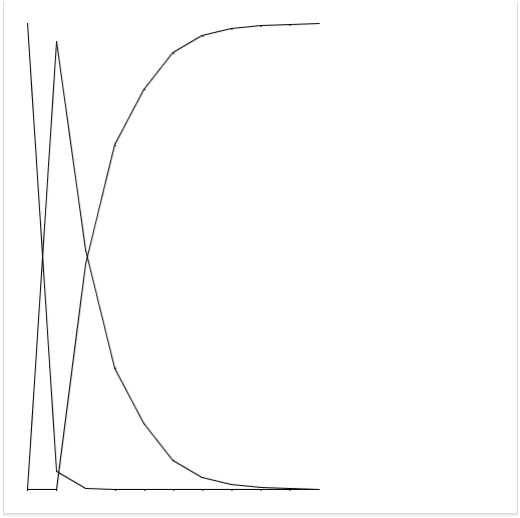
5 Second research

In this research, I want to search about how the change of A decay rate influences the number of steps. As table shows, there are ten researches. The last one is to show the less change rate for A decay rate. And I want to show the difference by comparing ninth and tenth research.

	k A to B	k B to C	The number of steps
1	0.1	0.5	64
2	0.2	0.5	41
3	0.3	0.5	25
4	0.4	0.5	20
5	0.5	0.5	13
6	0.6	0.5	14
7	0.7	0.5	13
8	0.8	0.5	12
9	0.9	0.5	12
10	0.95	0.5	10

We can see number of steps is decreasing and the rate of decreasing is also decreasing. It is very similar to the first research. But in 5,6,7 research, data seems no change at all. This is caused by the computer calculator error.





And here are 9 and 10 research. Clearly the second one is much shorter than first one. Also we can see the increasing for both A and B are very quickly. But the rate of increasing in second research is bigger than first research's. The B maximum in second research is higher, the process for B turn to C in second research is quicker than first one.

6 Conclusion

Anyway, A decay rate and B decay rate can influence the number of steps absolutely. And the maximum B will be influenced by B decay rate. The more B decay rate, the quicker B reach maximum. Decay Lab can help us to determine the relationship between decay rate and number of steps. On the other words, it can help us to understand the atoms' decay process.