Introduction

A solid sample contains two radioactive isotopes A and X. Their decay modes are

- $A \rightarrow B + \alpha$
- $X \rightarrow Y + \beta$

At t=0 isotope X is twice as numerous as isotope A ($N_A/N_X=2$). The percentage of nuclei for each isotope which are still the parent after time t (in years) is shown in the diagram overleaf.

Notes:

- Although each plot starts at 100%, there are not equal numbers of each nuclei.
- This assignment can be solved without resorting to complex calculations. If you you are using the exponential function, or are trying to calculate half lives, then you have over complicated the problem. The most complicated mathematics that is needed is simple arithmetic.
- The daughter nuclei B and Y are also solid, so that no material is lost from the sample.

Questions

1. When t=0, what fraction of all radioactive nuclei are of isotope A?
2. When t=10 years, what is the ratio of the number of parent nuclei A to the number of parent nuclei X (N_A/N_X)?
3. When t=10 years, what is the ratio of the number of daughter nuclei B to the number of daughter nuclei Y (N_B/N_Y)?
4. When t=10 years, what is the ratio of the number of α particles that have been produced to the number of β particles that have been produced (N_α/N_β)?