General Astronomy (29:61)
Fall 2012
Homework Set #4
Assigned: October 1, 2012
Due: October 12, 2012

1. In class I gave an expression for the decay of radioisotopes in terms of a constant α. This constant is different for different radioisotopes. Derive (don't just state) the mathematical relationship between α and the half life of a radioactive decay reaction.

2. 400 nuclei of a certain radioisotope (radioisotope A) are incorporated per cubic centimeter of a rock. The radioactive decay constant for that isotope is $\alpha = 0.400 \ \mathrm{Gyr}^{-1}$. After 4 Gyr, how many nuclei of isotope A are remaining? Show your work.

3. Assume that the radioisotope in problem # 2 decays into isotope B, and that no nuclei of B were contained in the rock when it formed. How many nuclei of isotope B are in the rock after 4 Gyr? Show your work.

4. A rock is analysed to determine its age of formation. The analysis is to be done with measurements of the radioactive decay of isotope A to B, $A \rightarrow B$, with a half-life of 1.54 Gyr. There is also an isotope C, of the same element as B, that is not involved in radioactive decay processes.

   When the rock is analysed, there are two distinct minerals present in it. Mineral 1 has the following numbers of nuclei per cubic centimeter: 66 nuclei of A, 484 of B, and 250 of C. Mineral 2 has 107 nuclei of A, 643 of B, and 167 of C.

   With these data, determine the age of formation of this rock. Show all of your calculations.

5. What is the meaning of the term *Impact Basin* in the context of the study of the Moon? We did not have the chance to cover this important topic in class. Explain the relevance of impact basins to topics we did discuss in class. Be sure and give the source for your information. Get something more substantive than Wikipedia, although Wikipedia can be used to give you an initial idea.

6. Problem 4.1 from the textbook.

7. Problem 4.9 from the textbook.