Übungen 2

1. 1g of Radium (assume pure ^{226}Ra) has an activity of 1Ci which corresponds to $3.7 \cdot 10^{10}$ decays/s. Determine how many atoms of ^{226}Ra are in the 1 g of material. Determine the decay constant and the half-life of ^{226}Ra.
2. The human body on the average contains about 18% carbon and 0.27% potassium. Compute the intrinsic activity of the average person from ^{14}C and ^{40}K (Assume the mass of an average human is 70 kg and that 0.012% of potassium is ^{40}K. Also, the isotopic ratio of $^{14}C / ^{12}C = 1.3 \times 10^{-12}$).
3. Naturally occurring samarium includes 15.1% of the radioactive isotope ^{147}Sm, which decays by alpha emission. One gram of natural Sm gives 89 decays per second. From these data calculate the half-life of the isotope ^{147}Sm.
4. Calculate the internal dose per year that you receive from the ^{14}C contained in your body (take the body parameters of problem 2). The ^{14}C emits β^- radiation with an energy of 152 keV. The half-life of ^{14}C is 5730 years.
5. The earth mantle has a total activity of $1.3 \cdot 10^{15}$ Ci. Calculate the released decay energy assuming that 1/3 of the activity is coming from alpha emission with an average energy of 3.5 MeV.
6. Which nuclear reactions produce neutrons in the interior of earth?
7. Earth atmosphere contains 66 tera-tons of ^{40}Ar. These argon atoms have been generated by radioactive decay of ^{40}K in earth. Assuming that this process has started with the formation of the earth system 4.6 Billion years ago, how many ^{40}K nuclei have decayed over that period of time. (take into account the ^{40}K decay branching ratio!)