11.1.1 \(^{212}\text{Po}\) has a half-life of 0.30 \(\mu\text{s}\). How long does it take until only 1/16 of the original nuclei of a sample remains?

Answer: 1.2 \(\mu\text{s}\)

11.1.2 Calculate the number of atoms in 1.0 g of \(^{226}\text{Ra}\).
The Avogadro’s number is 6.026 \(\times\) 10\(^{26}\) atoms/kg.

Answer: \(26.7 \times 10^{20}\) atoms.

11.1.3 The half-life for radium 226 is 1620 years. Use the problem above to calculate the activity of 1.0 gram radium.

Answer: 3.6 \(\times\) 10\(^{10}\) decay/s.
This is the equal to 1.0 Curie that earlier was the definition of activity, i.e.1 Ci.

11.1.4 One measures a decay rate of 735 \(\alpha\)-particles/minute from 1.0 mg \(^{238}\text{U}\).
Determine the half-life of \(^{238}\text{U}\).

Answer: 4.5 \(\times\) 10\(^9\) years

11.2.1 \(\alpha\)-particles from \(^{210}\text{Po}\) has an measured kinetic energy of 5.3 MeV.
How large is the decay energy \(Q\)?
Answer: 0.122 MeV

11.3.1 One studies a free neutron that decays to a proton The half-life is 12.8 minutes. One measures the maximum kinetic energy for the electron to 781 keV.
Determine the mass of the neutron.

Answer: 1.008663 u

11.4.1 \(^{60}\text{Co}\) decays through \(\beta\)-decay to an excited state of nickel, \(^{60}\text{Ni}\). After that a \(\gamma\)-photon with the energy 1.173 MeV is ejected and thereafter a new \(\gamma\)-photon is ejected with the energy 1.333 MeV down to the ground state of \(^{60}\text{Ni}\).
Determine how big the power is, that 1.0 g \(^{60}\text{Co}\) generates.

Answer: 16 W

11.4.2 One wants to perform an age determination with the Carbon-14 method on a sample containing 1.0 gram carbon. One measures the activity to 0.415 decays/minute performed during 24 hours. The original activity was 0.233 decays per gram and second.
Determine the age of the sample.

Answer: 2.9 \(\times\) 10\(^4\) years
11.5.1 One achieves a fusion between deuterium and tritium, i.e. between $^2\text{H}$ and $^3\text{H}$ and gets $^4\text{He}$ and a neutron. Calculate how much kinetic energy that is achieved in the reaction.

Answer: 17.6 Mev

11.6.1 We shoot neutrons onto $^{235}\text{U}$ in order to create $^{236}\text{U}$. The potential barrier of 5.3 MeV has to overcome in order to make the fission to occur. Investigate if fission is possible with slow neutrons.

Answer: The mass difference gives the energy 6.1 MeV which is larger than the barrier, why it is enough with slow neutrons with $E_k = 0$