1. Compute the binding energy, E_B, and binding energy per nucleon, E_B/A, for the nuclei ^{208}Pb and ^{133}Cs.

2. Compute the kinetic energy of an α-particle produced in the decay of ^{234}U. Is it justified to approximate the kinetic energy by the non-relativistic limit, $E_{\text{kin}} = |\mathbf{p}|^2/(2M_\alpha)$? Justify your answer.

3. As a result of a radioactive decay chain, $^{232}_{90}$Th decays into $^{208}_{82}$Pb nuclei.

   a) How many α decays does the chain contain?

   b) How many β decays does the chain contain?

   c) Compute the energy Q released in the decay chain.

4. In the harsh north, in the heart of Häme, an encounter between the last Pirkkala men and a group of Nokian bandits ends in defeat for the poor Pirkkala men after a brief but uneven battle. During archaeological excavations at the site, a fragment of a wooden club belonging to one of the Pirkkala men is discovered. Its measured ^{14}C activity is 0.152 Bq. A fragment of the same size, taken from freshly cut wood, has an activity of 0.207 Bq. Estimate when the defeat of the brave Pirkkala men took place, given that the half-life of the ^{14}C isotope is $\tau_{1/2} = 5730$ years *(you may google "viimeiset pirkkalaiset" if you wonder what all this is about).*

5. As a result of the Chernobyl nuclear power plant accident, radioactive substances were carried to Finland in April 1986. The radioactive fallout included the isotope Cesium-137, which has a half-life of $\tau_{1/2} = 30.23$ years. In 2008, the ^{137}Cs concentration in a mushroom sample collected in southwestern Finland was 600 Bq/kg. Estimate the ^{137}Cs concentration in an equivalent sample immediately after the accident and at the present time.

Table values for atomic masses:

$$
\begin{aligned}
M(^1\text{H}) &= 1.0078250\,\text{u} \\
M(^4\text{He}) &= 4.002603\,\text{u} \\
M(^{133}\text{Cs}) &= 132.905452\,\text{u} \\
M(^{208}\text{Pb}) &= 207.976652\,\text{u} \\
M(^{230}\text{Th}) &= 230.033132\,\text{u} \\
M(^{232}\text{Th}) &= 232.038054\,\text{u} \\
M(^{234}\text{U}) &= 234.040950\,\text{u}
\end{aligned}
$$