1. A hypothetical water sample is characterized by the following mole fractions:

\[
\frac{n^{17}O}{n^{16}O} = 0.00039 \quad \frac{n^{18}O}{n^{16}O} = 0.00210
\]

a) Calculate the isotopic abundance of each of the three stable isotopes.

b) Calculate the atomic weight of the oxygen in this sample.

2. Calculate the binding energy (in Mev) associated with \(^{40}\text{Ca}\) and \(^{40}\text{K}\). [watch your units]

3. Consider the fusion reaction: \( ^1H + ^1H \rightarrow ^2\text{He} + \Delta E \)

a) Calculate \( \Delta E \) (in Mev) for this reaction.

b) If the observed \(^3\text{He}\) flux from the Earth is \(2 \times 10^{19}\) atoms/s, what fraction of Earth’s heat flux (1.2 x \(10^{-6}\) cal/cm\(^2\)/s) can be explained by this reaction?

4. How much \(^{14}\text{C}\) would you expect to find in a 1g wood sample formed in 2000 B.C.?

5. Calculate the activity (in dpm/liter) of \(^{40}\text{K}\) and \(^{238}\text{U}\) in seawater. \([\text{K}] = 400\text{ppm} ; \ [\text{U}] = 3\text{ppb} \]
   [Hint: you will first need to calculate the atoms/liter for K and U]

6. If the \(^{238}\text{U}\) series isotopes in seawater were in secular equilibrium (they are not), what would be their combined activities (in dpm/liter)?

7. You are charged with measuring the half-life of \(^{238}\text{U}\). Like a smart geochemist, you take a 3.5g rock that has a known \(^{238}\text{U}\) concentration of 1.8ppm, separate the \(^{238}\text{U}\), and plate it onto an alpha-counter source and measure its decay rate. How long would you have to count to determine the half-life to a 1\(\sigma\) accuracy of 1\%? What if you needed to know the half-life to a 2\(\sigma\) accuracy of 0.1\%?