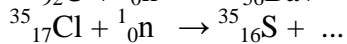
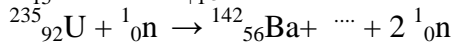
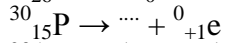
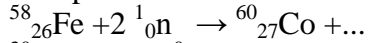


Exercises Series N°2

Exercise 1

Complete the nuclear reactions :



Exercise 2

The radioactive radon ${}^{222}_{86}\text{Rn}$ emits α particles with a period $T = 3,76$ days.

- 1) Write the nuclear decay reaction.
- 2) Calculate the initial mass m_0 of the sample, given that its initial activity is $A_0 = 4,7 \cdot 10^3 \text{ Ci}$.
- 3) Calculate the activity of the sample at time $t = 20$ days.
- 4) Determine the time t at which its activity would have decreased by 35%.

Data : $N_A = 6,022 \cdot 10^{23}$, $1 \text{ Ci} = 3,7 \cdot 10^{10} \text{ dps}$

Exercise 3

Bismuth ${}^{212}_{83}\text{Bi}$ is radioactive and emits α particles.

- 1) Write the nuclear decay reaction.
- 2) Calculate the initial mass m_0 of Bi , knowing that after $t = 15 \text{ min}$, $N_d = 4,484 \cdot 10^{19}$ nuclei have disintegrated, and the periode of Bi is $T = 5$ days.
- 3) If initially taking $m_0 = 4,2 \text{ Kg}$ of the element, what would be the mass of this sample after 22days ?

Exercise 4

Let there be an element X that decays into an element Y and a negaton β^- . Given that the atomic number of Y is 28 and the nucleus of X contains 33 neutrons:

- 1) Write the nuclear decay reaction.
- 2) Knowing that we initially have 0,012 kg of element X and that after 15 days we have obtained $9,0345 \cdot 10^{22}$ β^- particles, determine the half-life of element X.
- 3) Determine the activity in curies of element X after 30 days.

Exercise 5

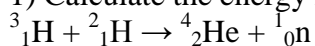
In a nuclear power plant, each uranium nucleus undergoes fission when struck by a slow neutron. One of the possible processes leads to the formation of a cesium nucleus, a zirconium nucleus, neutrons, electrons, and photons.

- 1) Write this fission reaction.
- 2) Calculate:
 - a. The mass loss accompanying this fission reaction.
 - b. The energy released, in joules and in MeV, during the fission of one gram of uranium (neglecting the mass of the electron).

Data : ${}^{235}_{92}\text{U} = 235,0439 \text{ amu}$, ${}^{137}_{55}\text{Cs} = 136,9098 \text{ amu}$, ${}^{97}_{40}\text{Zr} = 96,9139 \text{ amu}$, ${}^1_0\text{n} = 1,0087 \text{ amu}$.

Exercise 6

1) Calculate the energy released by the following nuclear fusion reaction:



- 2) Calculate the energy released during the formation of one mole of helium nuclei.
- 3) What quantity of coal is required to produce the same amount of energy as calculated in question (2)?

The heat of combustion of coal is given as 8000 cal/g.

Data : ${}^3_1\text{H} = 3,01604 \text{ amu}$, ${}^2_1\text{H} = 2,0140 \text{ amu}$, ${}^4_2\text{He} = 4,00260 \text{ amu}$, ${}^1_0\text{n} = 1,00866 \text{ amu}$