University Center of Mila **Academic year :2024/2025**
Institute of Science and Technology **Module : Structure of matter**
First Year ST

Series Nº 3

Exercise 1:

Consider the following nuclear reaction:

$$2\ {}^{1}_{1}\mathrm{H} + 2\ {}^{1}_{0}\mathrm{n} \longrightarrow {}^{4}_{2}\mathrm{He}$$

1) Calculate the change in mass Δm, The masses of each species are given below.
2) Calculate the binding energy in MeV
3) Calculate the binding energy per nucleon in J and eV .
4) Calculate the binding energy in joules and calories per mole of nucleons.

Masses:

neutron = 1.00866 amu

proton = 1.0073 amu

helium = 4.0026 amu

Exercise 2:

A) Write the balanced equation for the nuclear reactions:

$^{130}_{52}Te(d,2n)^{130}_{53}I$, $^{40}_{18}Ar(\alpha,P)^{43}_{19}K$, $^{55}_{25}Mn(n,\gamma)^{56}_{25}Mn$, $^{15}_{8}O(\beta^{+})^{15}_{7}N$, $^{14}_{6}C(\beta^{-})^{14}_{7}N$

B) Write the balanced equation for the nuclear reaction $^{56}_{25}Mn(\beta^{-})^{56}_{26}Fe$

1) It was found that in 7.5 hours, 1 mole of ^{56}Mn decays to gives 49 g of ^{56}F. What is the half-life time of manganese?

2) Calculate the mass of a sample of manganese. Its activity is 2 x 10^6 Ci.

3) Calculate the energy resulting from disintegration a nucleus of Mn, and then for 1 mole.

Given ^{56}Mn = 55,93948 mau, ^{56}Fe =55,93493 mau

Exercise 3:

The Thorium $^{232}_{90}Th$ disintegrates to gives $^{208}_{82}Pb$, Calculate the number of α and β^{-} particles emitted during this disintegration.