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Exercises Series N°1

Exercise 1 :

1) Give the number of protons, neutrons and electrons for the following atoms:
$_6{}^{12}C$, $_6{}^{13}C$, $_6{}^{14}C$, $_9{}^{19}F$, $_{11}{}^{23}Na$, $_{13}{}^{27}Al$, $_{35}{}^{79}Br$, $_{35}{}^{81}Br$, $_8{}^{16}O$, $_{92}{}^{235}U$.
2) Are there isotopes among these atoms?
3) Deduce the number of electrons and the symbolic notation (mass number A and atomic number Z) for the ions : F^-, O^{2-}, Na^+, Al^{3+}.

Exercise 2 :

Let's consider the element Calcium ($^{40}_{20}Ca$).
1) Define the atomic mass unit (a.m.u), calculate its value.
2) Deduce the mass of the proton, neutron, and electron in this unit.
3) Determine, in a.m.u, the mass of the nucleus, then that of the atom of the element Calcium. Conclude.
4) Calculate the molar atomic mass of this element.
Data : $m_p=1,6723842.10^{-24}g$; $m_n=1,6746887.10^{-24}g$; $m_e=9,109534.10^{-28}g$.

Exercise 3 :

I) Calculate the average mass of natural iron, knowing that it is a mixture of four isotopes.

Isotope	Mass (amu)	Abundance (%)
^{54}Fe	53,939	05,22
^{56}Fe	55,935	91,66
^{57}Fe	56,935	02,1
^{58}Fe	57,933	0,33

II) Natural gallium consists of two isotopes: ^{69}Ga and ^{71}Ga, with masses of 68,9256 amu and 70,9247 amu, respectively. Knowing that there is 60,11% of ^{69}Ga, what is the average atomic mass of natural gallium?

Exercise 4 :

Natural copper (Z=29) consists of two isotopes : ^{A1}Cu and ^{A2}Cu, with respective atomic masses of 62,9296 amu and 64,9278 amu. The average atomic mass of natural copper is equal to 63,546 amu.
1) Deduce A_1 and A_2.
2) Provide the composition of the nucleus of each isotope.
3) Calculate the relative abundance of each isotope.
4) Calculate, in Joules and eV, the binding energy of each isotope.
5) Give, with justification, the stability order of the nuclei of the two isotopes.
Data : m_n = 1,00867 amu ; m_p= 1,00728 amu ; C = 3. 10^8 m/s

Exercise 5 :

Silicon (Z=14) is a mixture of three stable isotopes: ^{28}Si, ^{29}Si, ^{30}Si; the natural isotopic abundance of the most abundant isotope is 92,23%. The average mass of natural silicon is 28,085 amu.
1) Provide the nuclear composition of each isotope.
2) Calculate the abundance of the other two isotopes.
3) Calculate, in MeV, the binding energy of each isotope.
4) Which is the most stable isotope?
Data: Masses in amu: ^{28}Si = 27,977 ; ^{29}Si = 28,976 ; ^{30}Si = 29,974.