University of Tlemcen
Faculty of technology
Department of Hydraulics

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STI

Tutorial Series N°2

Exercise 1

Select the correct answer(s) from the following:

1 – The theory of the atom was proposed by:

a – E. Rutherford; b – J. Dalton; c – J. Chadwick; d – J. J. Thomson

2 – Rutherford's experiment allowed us to conclude that:

a- The atom is empty; b- Atomic mass is distributed throughout the whole atom;

c – The center of the atom has a positive charge; d – The center of the atom is empty

3 – According to the Rutherford experiment, the volume of the nucleus relative to the volume of the atom is:

a – 25% ; b – 50% ; c – negligible ; d – 75%

4 – The number of protons of an atom is called:

a – Atomic mass; b – Protons number ; c – Mass number ; d – Atomic number

5 – Isotopes of an element have:

a– The same number of protons and neutrons; b - The same number of neutrons and a different number of protons; c- The same number of protons and a different mass number;

d – The same number of protons and a different number of neutrons.

Exercise 2

A/ For each statement, indicate TRUE or FALSE:

1- The diameter of an atom is equal to the diameter of its nucleus.……

2- The electron of an aluminium atom is different from the electron of a zinc atom.……..

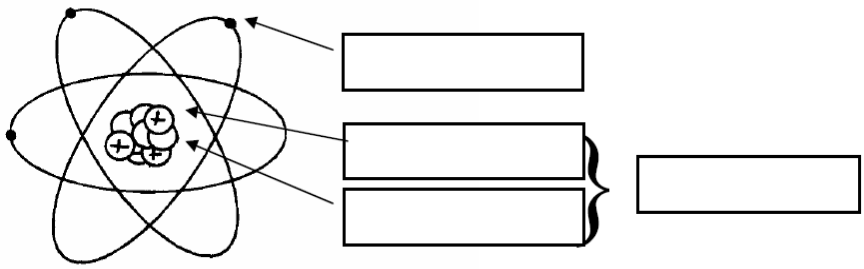
3- A metal has electrons.……..

4- Between the nucleus and the electrons there is a gas.…….

5- The centre of the atom carries a positive charge …….

6- The number of protons in an atom is called the mass number.…….

B/ Complete the diagram corresponding to the constituents of an atom according to Rutherford's model:



1) Indicates the sign of the electric charge carried by its components

2) Indicate the number of protons, neutrons and electrons in the following structures:

$^{1}_{1}H$; $^{16}_{8}O$; $^{31}_{15}P$; $^{23}_{11}Na^{+}$; $^{16}_{8}O^{2-}$; $^{127}_{53}I^{-}$; $^{9}_{4}Be^{3+}$; H_2O ; PO_4^{3-}

Exercise 3

We assume that the mass of the phosphorus atom $^{31}_{15}P$ is equal to the sum of the masses of the particles that make it up.

1) What is the mass of the nucleus of a phosphorus atom?
2) What is the mass of the electron cloud of a phosphorus atom?
3) What is the mass of a phosphorus atom? What conclusion do you draw?

Exercise 4

The mass of all the electrons in the iron atom is $2{,}366.10^{-29}$ kg.

1- Knowing that one electron has a mass of $9{,}1.10^{-31}$ kg, how many electrons does an iron atom have?

2- What is the number of positive charges carried by the nucleus of the iron atom?

3- Deduce the atomic number of the iron atom. The mass of an iron atom is $9{,}3.10^{-26}$ kg.

4- Calculate the number of iron atoms that make up an iron nail of 2,5 g.

Exercise 5

A. The nucleus mass of an entity is m = $45{,}159.10^{-27}$ Kg and has and carries an electric charge q = $20{,}8.10^{-19}$ C. the electron cloud contains 10 electrons.

1. What is atomic number Z and mass number A?
2. Is it an atom or an ion?

Data: - elementary charge e = $+1{,}6.10^{-19}$ C

-Proton mass $m_p = 1{,}673.10^{-27}$ Kg

B.

1.What is the number of protons, neutrons and electrons of ion NO^-_3

2.consider ion formed by one (1) phosphorus atom and (4) oxygen atoms. The total numbers of protons is 47, the total number of neutrons is 48 and the total number oh electrons is 50. What is the chemical formula of this ion?

Data: ^1_1H, $^{16}_8O$, $^{31}_{15}P$, $^{14}_7N$

Exercise 6

A. Consider an atom whose nucleus contains 16 neutrons and has a total charge:

q = $+2{,}56.10^{-18}$ C

1.what is the atomic number of nucleus?

2.what is its nucleons number?

3.haw many electrons are in the electron cloud?

B. the same questions as A for an ion whose charge is $q_{ion} = +4{,}8.10^{-19}$ C. its nucleus contains 28 neutrons and its charge q = $+3{,}84.10^{-19}$ C.

Data: e = $1{,}6.10^{-19}$ C

Exercise 7

Given an ion with charge $q_{ion} = +4{,}8.\ 10^{-19}$ C. its nucleus contains 28 neutrons and has a charge $q_{nucleus} = +\ 3{,}84.\ 10^{-18}$ C.

1) is it a cation or an anion?

2) Determine its number of protons and nucleons.

3) How many electrons this ion has in its electron cloud?

4) Give the symbol of this ion.

Exercise 8

Silver $_{47}Ag$ occurs naturally as mixture of two isotopes ^{107}Ag and ^{109}Ag.

1) Give for each isotope : atomic number, mass number, number of protons and number of neutrons.
2) The atomic mass of natural silver is M= 107,96g. Calculate the relative abundance of these two isotopes.

Data : Masses isotopiques ^{107}Ag (M_1 = 106,90g) et ^{109}Ag (M_2 = 108,90g)

Exercise 9

1- Among the following groups, indicate the isotope groups $^{206}_{82}X$; $^{238}_{92}X$; $^{45}_{21}X$; $^{207}_{82}X$; $^{48}_{21}X$; $^{237}_{92}X$.

2- Calculate the average relative atomic mass (isotopic average) of the element magnesium, knowing that it is composed of the following isotopes: ^{24}Mg (78,99 %); ^{25}Mg (10,00%) ; ^{26}Mg (11,01 %).

3- Knowing that the average relative atomic mass of boron is 10,81 uma and of its two isotopes, ^{11}B is the more abundant (80.22%), so what is the second isotope

4- The relative atomic mass of neon is 20,18 uma. Formed by 90,92 % of ^{20}Ne, 0,26% of ^{21}Ne and 8,82 % of a third isotope. What is the relative isotopic mass and composition of this 3rd isotope?

Exercise 10 (for student)

The nucleus of an entity has a mass m = $5{,}51.10^{-26}$ Kg and carries the electric charge q = $2{,}56.10^{-18}$C. The electron cloud contains 18 electrons.

1) Determine the atomic number and mass number of the nucleus.
2) Is it an atom or an ion?
3) What is the charge, in coulomb, of this entity?