UNIVERSITY ABOU BAKR BELKAID – TLEMCEN
Faculty of technology **IGM**
Mechanical Engineering Department **2024/2025**

Tutorial N°2

Exercise 1:

Choose the right answer(s):

1-_____ said that everything in the universe is made up of tiny particles called atoms.

A. Democritus **B.** Dalton **C.** Copernicus **D.** Aristotle

2- What did JJ Thomson discover?

A. Electrons **B.** Nucleus **C.** Proton **D.** Neutrons

3-Milliken said that the electron has:

A. No charge and a large mass
B. A charge and a large mass
C. A charge and a small mass
D. A positive charge always

4-Ruthorford said that the electrons circle the nucleus with a fixed orbit.

A. True **B.** False

5-Chadwick discovered the electron.

A. True **B.** False

6-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

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

A. True **B.** False

8-The centre of the atom carries a positive charge.

A. True **B.** False

9-The number of protons of an atom is called:

A. Atomic mass
B. Protons number
C. Mass number
D. Atomic number

10-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:

1. Give, in table form, the mass, proton, neutron and electron numbers of the following elements and ions:

$$^{40}_{19}K;\ ^{3}_{1}H;\ ^{16}_{8}O;\ ^{58}_{26}Fe;\ ^{24}_{12}Mg;\ ^{76}_{34}Se;\ ^{18}_{8}O^{-2};\ ^{25}_{12}Mg^{+2};\ ^{2}_{1}H;\ ^{56}_{26}Fe^{+2}$$

2. List the different isotopes.

Exercise 3:

Complete the following table:

Symbol	Number of Protons in Nucleus	Number of Neutrons in Nucleus	Number of Electrons	Net Charge
$^{238}_{92}$U	—	—	—	—
—	20	20	—	2^{+}
—	23	28	20	—
$^{89}_{39}$Y	—	—	—	—
—	35	44	36	—
—	15	16	—	3^{-}

Exercice 4:

If you know that the mass of the potassium atom $^{40}_{19}K$ is equal to the sum of the masses of the all its particles calculate :

1. The mass of the nucleus
2. The mass of the electron cloud
3. The mass of the potassium atom
4. What can we deduce?

Exercice 5:

A- Given that the mass number (atomic mass) of gold is **197**, calculate the number of gold atoms in a 2.5 g piece of 18-carat gold jewelry.

B- The total mass of all the electrons in a gold atom is approximately 7.20×10^{-29} kg. Deduce it atomic number.

Exercice 6:

A- In an experiment it was found that the total charge on an oil drop was 5.93 $x10^{-18}$ C. How many negative charges does the drop contain?

B- 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. how many electrons are in the electron cloud?

C- 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.

Exercise 7:

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?

Exercices 8 :

A- Neon has three naturally occurring isotopes: **^{20}Ne** (isotopic mass = 19.9924 amu, abundance = 90.48%), **^{21}Ne** (isotopic mass = 20.9938 amu, abundance = 0.27%) and **^{22}Ne** (isotopic mass = 21.9914 amu, abundance = 9.25%)

- Calculate the atomic mass of neon.

B- Chlorine has two naturally occurring isotopes, **^{35}Cl** (isotopic mass 34.9689 amu) and **^{37}Cl** (isotopic mass 36.9659 amu). If chlorine has an atomic mass of 35.4527 amu.

-What is the percent abundance of each isotope?

Exercise 9:

Magnesium has three naturally occurring isotopes:

- **Magnesium-24** (mass = 23.985 amu, abundance = 78.99%)
- **Magnesium-25** (mass = 24.986 amu, abundance = 10.00%)
- **Magnesium-26** (mass = 25.983 amu, abundance = 11.01%)

1. Explain what an **isotope** is, using magnesium as an example.
2. Calculate the **relative atomic mass** of magnesium.
3. If a sample of magnesium contains 1.00 mol of atoms, how many atoms of magnesium-25 are present?

Exercise 10:

A- Obtain the mass defect (in amu) and binding energy (in MeV) for the $^{58}_{28}Ni$ nucleus. What is the binding energy (in MeV) per nucleon?

Data : atomic mass of $^{58}_{28}Ni$**=57.93534 amu.**

B- Consider the following two atoms $^{235}_{92}U$ and $^{140}_{54}Xe$

-Compare the stability of these two atoms.

Data m_U**=234,9942** u and m_{Xe}**=139,9252** u

Exercice 11:

Natural iron $^{58}_{26}Fe$ consists of four stable isotopes (n°1 to n°4) whose natural abundances are shown below:

Isotopes	$^{54}_{26}Fe$	$^{56}_{26}Fe$	$^{57}_{26}Fe$	$^{58}_{26}Fe$
Atomic mass	53,9399	55,9349	56,9350	57,9330
Abundance %	5,84	91,75	2,12	0,28

1. Give the composition of each isotopes.
2. Find the natural average mass of iron.
3. Calculate the mass defect in (u) of the nucleus $^{56}_{26}Fe$ **.**
4. Calculate the binding energy per nucleon of $^{56}_{26}Fe$ in **J** and **MeV**.

	Charge (C)	**Mass (amu)**	**Mass (g)**
Electron	-1.602×10^{-19}	0.00055	0.00091×10^{-24}
Proton	$+1.602 \times 10^{-19}$	1.00727	1.67262×10^{-24}
Neutron	0	1.00866	1.67493×10^{-24}