UNIVERSITY ABOU BAKR BELKAID - TLEMCEN
Faculty of technology **IGM**
Mechanical Engineering Department **2025/2026**

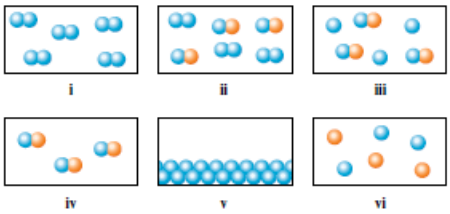
Tutorial N° 1

Exercise1

Match each description below with the following microscopic pictures. More than one picture may fit each description. A picture may be used more than once or not used at all.

a. a gaseous compound
b. a mixture of two gaseous elements

c. a solid element
d. a mixture of a gaseous element and a gaseous compound



Exercise 2

1) What is the difference between homogeneous and heterogeneous matter? Classify each of the following as homogeneous or heterogeneous.

a. a door
b. the air you breathe
c. a cup of coffee (black)
d. the water you drink
e. salsa

2) Classify each of the following as a mixture or a pure substance.

a. water
b. blood
c. the oceans
d. iron
e. steal
f. uranium
g. leather
h. table salt (NaCl)

3) Of the pure substances, which are elements and which are compounds?

Exercise 3

Classify following as physical or chemical changes.

1- The melting of ice	**5-** Melt chocolate
2- Dissolution of table salt in water	**6-**The bleaching of a pair of jeans by bleach
3-Toast a slice of bread	**7-** Sugar caramelization
4-Cutting a sheet of cardboard.	

Exercise 4

What amount (moles) are represented by each of these samples?

a. 150.0 g Fe_2O_3 **c.** 1.5 x10^{16} molecules of BF_3

b. 10.0 mg NO_2 d. 15 mL of H_2SO_4 d= 1,83 g/cm³

Given:

M(Fe_2O_3)=159,69 g/mol, **M(NO_2)** = 46,01 g/mol, **M(H_2SO_4)** =98 g/mol.

Exercise 5

What number of atoms of nitrogen are present in 5.00 g of each of the following?

a. Glycine <<$C_2H_5O_2N$>>	**c. Calcium nitrate <<$Ca(NO_3)_2$>>**
b. Magnesium nitride <<Mg_3N_2>>	**d. Dinitrogen tetroxide <<N_2O_4>>**

Exercise 6

For 1mL of water calculate

a- The corresponding mass of water **b-** The number of moles of water

c- The number of moles of hydrogen **d-** The number of moles of oxygène

e- The number of water' molecules **f-** The number of hydrogen's atoms

g-The number of oxygen's atoms

Data : ρ (H_2O) = 1 g/cm^3 ; M (H_2O) =18 g/mol ; le nombre d'Avogadro= 6.023 10^{23}mole.

Exercise 7

Balance the following reactions :

$$Fe_2O_3(s) + CO(g) \longrightarrow Fe(s) + CO_2(g)$$

$$C_2H_5OH(l) + O_2(g) \longrightarrow CO_2(g) + H_2O(l)$$

$$NH_3(g) + O_2(g) \longrightarrow NO(g) + H_2O(g)$$

Exercise 8

Aluminum chloride, $AlCl_3$, is used as a catalyst in various industrial reactions. It is prepared from hydrogen chloride gas and aluminum metal shavings.

$$Al(s) + HCl(g) \longrightarrow AlCl_3(s) + H_2(g)$$

- Suppose a reaction vessel contains 0.15 mol Al and 0.35 mol HCl. How many moles of $AlCl_3$ can be prepared from this mixture?

Exercise 9

Potassium superoxide, KO_2, is used in rebreathing gas masks to generate oxygen.

$$KO_2(s) + H_2O(l) \longrightarrow KOH(s) + O_2(g)$$

If a reaction vessel contains 0.25 mol KO_2 and 0.15 mol H_2O, what is the limiting reactant?

How many moles of oxygen can be produced?

- What is the remaining quantity of H_2O?

Exercise 10

1. How many grams of $NiCl_2*6H_2O$ must be dissolved in a 0.25 L solution to create 1 M Ni(II) solution ? (MW $NiCl_2*6H_2O$ = 237.64 g/mol) ?
2. You want to create a 0.2 M solution of Ni^{2+} in a 25 mL volumetric flask using the 1 M solution prepared above. How would you go about making this solution ?
3. What is the concentration in ppm of Ni in the 0.2 M solution you just prepared ?

Exercise 11

In the label of a commercial solution flask of nitric acid HNO_3, we find: mass percentage= 68,0 %, Density: d=1,41and Molar mass: M = 63,0 g/mol.

1. Demonstrate that the molar concentration of nitric acid in this commercial solution is 15 $mol.L^{-1}$.
2. Determine the volume V_0 (mL) of commercial solution that needs to be taken for the preparation of V = 500 mL of nitric acid solution of concentration C = 1,0 mol/L.
3. Name this process

Exercise 12

1. Find the Normality of the solution containing 5.3 g/L of Na_2CO_3 (106 g/mol)
2. Determine the Normality of a solution prepared by dissolving 75 g of solid $Ba(NO_3)_2$ (261.32 g /mol) into 374 g of water.
3. The mass of an aqueous solution that contains 11.7 g of NaCl (58.5 g/mol) is 551.7 g . Calculate the molality of the solution.

Exercise 13

Calculate the percent composition by mass of the following compounds that are important starting materials for synthetic polymers:

1. $C_3H_4O_2$ (acrylic acid, from which acrylic plastics are made).
2. $C_4H_6O_2$ (methyl acrylate, from which Plexiglas is made).
3. C_3H_3N (acrylonitrile, from which Orlon is made**).**