University of Tlemcen   *Academic year 2025-2026*
Faculty of technology   *ST Engineer*
Science and technology Department

Tutorial Series N°1

Exercise 1

1-In thermodynamics, the part studied is called …………, the rest constitutes……..

The studied part + rest is called …………

2-Give the definitions of:

- open system, closed system and isolated system.

- Extensive and intensive.

Exercise 2

1- Classify the following systems as open, closed, or isolated, and specify the type of exchange (matter and/or energy) that occurs between each system and its surroundings:

You, a tree, a moving car, a turned-on TV, the liquid in a thermometer, hot coffee in a thermos, the universe, boiling water, burning wood, sealed test tube.

2- Among the following variables, identify which are intensive and which are extensive:

Pressure, Volume, Mass, Temperature, Mole fraction of component i, Molar concentration, Molar volume, Energy, Power, Surface area, Speed, Mass density

Exercise 3

State and give the expressions of the following laws:

    a- Boyle-Mariotte Law

    b- Charles Law

    c- Gay-Lussac Law

    d- Dalton's Law

Exercise 4

If the composition of air is given in percentages: N_2 = 79.04%, O_2 = 20.93%, and CO_2 = 0.03%. Determine the partial pressures of these components under standard conditions

Exercise 5

Determine the value of the universal constant R for ideal gases, given that 1 mole of ideal gas occupies a volume of 22.4 litres at a pressure of 1 atm at 0°C:

1- in L. atm. K^{-1}.mol^{-1}

2- in Joule. K^{-1}.mol^{-1}

3- in cal. K^{-1}.mol^{-1}

4- in L.mmHg.mol^{-1}.K^{-1}.

Exercise 6

We find that a mass of 0.896 g of a gaseous compound (assumed to be ideal) occupies a volume of 524cm^3 at a pressure of 730 mmHg and a temperature of 28°C.

What is the molar mass of this gaseous compound?

Exercise 7

A mass m=12 g of a diatomic gas, assumed to be ideal, occupies a volume V=9.36 L at a pressure $P_1=10^5$ Pa and a temperature $T_1=27°C$.

a. Determine the molar mass of this gas and identify it.

b. Determine the density of this gas at temperature $T_2 =50°C$ and pressure $P_2=1.5 P_1$.

Exercise 8

A. The density of an ideal gas is 2.48 g/L at a pressure of 0.96 atm and at 21°C.

Calculate its molar mass. Deduce the value of the density of this gas under standard conditions of temperature and pressure (STP).

B. If the specific mass of dry air at 27°C and 740 torr is 1.146 g/dm^3, calculate its composition, assuming it consists only of N_2 and O_2.

Data: 1torr =1 mmHg , 1 atm = 760 mmHg , R= 0,0821 L atm mol^{-1} K^{-1} , M(N) : 14 g/mol , M(O) : 16 g/mol.

Exercise 9

A/ 2.0 L container contains carbon dioxide at 20°C under 1.0 atm. Add 1.0 g of nitrogen and heat the mixture to 200°C.

What are the partial pressures of the two gases and the total pressure in the container?

We give: M(N)= 14 g mol^{-1}, R= 8,314 J $mol^{-1}K^{-1}$ et R=0,082 L atm $mol^{-1}K^{-1}$

Exercise 10

1-What is the mass of chlorine contained in a dimensionally stable container of volume 12 cm^3 at a temperature of 11°C and a pressure of 1 atm? (the gas is assumed to be ideal).

2-At what temperature does the gas pressure become equal to 5 atm?

3-At this temperature, 0.001 moles of nitrogen are added. Calculate the partial pressure of each gas and the total pressure.

We give: M(Cl)=35,453 g mol^{-1}

Exercise11

Consider two containers, one containing hydrogen and the other methane. Initially, we have :

H_2 : P_1=5atm T_1= 250K V_1=10L

CH_4 : P_2=40atm T_2=300K V_2=30L

1-Calculate the mass of hydrogen and methane contained in each container.

2-Heat the two containers to a temperature of 350 K. Calculate the pressure of the hydrogen and methane.

3-Using a tap, connect the two containers. Calculate the partial pressures of the two gases. Deduce the total pressure.