Badji Mokhtar University Annaba **2025/2025**
Faculty of Science
Department of Material Sciences

Series N°1 Part 1
Thermodynamics in general

Exercise 01:
Give the dimensions of the perfect gas constant (R) and determine its value when expressed:
1-In L.atm/mol.K.
2-In J/ mol.K.
3-In L.mmHg/mol.K.
4-In cal/mol.K.
Knowing that 1mol of perfect gas occupies a volume of 22.4L under normal conditions of pressure and temperature.

Exercise 02:
A syringe contains 18 cm 3 of air at normal pressure ($P=1{,}013x10^5Pa$).
- The end of the syringe is capped and the plunger is pushed to reduce the volume of gas to 6.0 cm^3.
- Assume that the temperature remains constant.
- In pascal, what is the gas pressure in the syringe?

Exercise 03:
Two vials of identical volume contain identical masses of krypton and argon. If the argon flask is at 20°C, at what temperature must the krypton flask be for the pressures in the two flasks to be identical?
Molar mass : Ar (M_1=40 $g.mole^{-1}$); Kr (M_2=84 $g.mole^{-1}$).

Exercise 04 :
A 1Kg mass of air undergoes the following transformation:
Initial state: P1≈105 Pa (atmospheric pressure).
V_1≈ 0.9.m3 Final state: $P_2 \approx 4.5.105$ Pa
$V_2 \approx$?
The transformation 1and 2 is such that the product P.V= Cste.
1- Calculate V_2.
2- Draw the curve representing the transformation (P = f(V)).
3- Calculate the work exchanged during this transformation.

Exercise 05:
A given mass of gas is considered in 3 successive states:
State 1 characterized by P_1, V_1, T_1.
State 2 characterized by P_2, V_2, T_2.
State 3 characterized by P_3, V_3, T_3.
Given: $P_1 = 1.0 \times 10^5$ Pa, $V_1 = 2.0$ L and $T_1 = 300$ K.
a) The transition from state 1 to state 2 takes place at constant pressure by a temperature rise of 20 K. Determine P_2, V_2, T_2.
b) The transition from state 2 to state 3 takes place at constant temperature by an increase in pressure of 1.0×10^4 Pa. Determine P_3, V_3, T_3.

Exercise 06:
1) Calculate the work W carried out during the reversible isothermal expansion at 20°C of 32g of O_2 (g), assumed to be perfect, from 2.10^5 Pa to 10^5Pa. M(O) = 16g/mol is given.
2) Calculate the work W carried out if the same expansion were irreversible.
3) Compare the values obtained.