Abdelhafid Boussof University Center - Mila

Institute of Sciences and Technology **Academic Year: 2024/2025**
Course: Thermodynamics **First Year ST**

Series Nº 1

Exercise 1:

1. Ideal gases obey the equation: PV= nRT, where R is the ideal gas constant.
   Write the equation for R and calculate its numerical value in the following systems:
   $cal.mol^{-1}.K^{-1}$, CGS, SI, $L.atm.mol^{-1}.K^{-1}$
   Given that under standard conditions, one mole of an ideal gas occupies a volume of 22.4 liters.
2. Deduce the conversion factor from L.atm to both J and cal.

Exercise2:

A gas with a mass of 3.062 g occupies a volume of 1.224 L at 10°C and a pressure of 2 atm. Under what pressure will 0.436 g of the same gas occupy a volume of 300 mL at a temperature of 25°C?
Assume the gas obeys the ideal gas law.

Initial State	Final State
M_1 = 3.062 g	M_2 = 0.436 g
V_1 = 1,224 l	V_2 = 300 ml = 300.10^{-3} l
T_1 = 10 + 273,15 = 283,15 K	T_2 = 25 + 273,15 = 298,15 K
P_1 = 2 atm	P_2 = ?

Exercise 3:

1. 0.25 moles of an ideal gas initially under standard conditions (1 atm) is compressed until its pressure reaches 5 atm, and its volume is reduced to a quarter.
   - What is the final temperature of the gas?
   - Calculate the initial volume and deduce the final volume.
2. A gas under a pressure of 6 atm and a volume of 2 L expands at a constant temperature until its volume triples. What is its final pressure?

Exercise4:

a) A rigid vessel with a volume of 10 L contains 8 g of ideal helium gas (He) and 20 g of ideal neon gas (Ne) at 305 K. Calculate the total pressure and the partial pressure of each gas in the vessel.
b) In another experiment, helium gas (He) is in the first tank with a volume V1 under a pressure of 1 atm, and neon gas (Ne) is in the second tank with a volume V2 under a pressure of 4 atm. If $V_2=2V_1$ and the two tanks are connected by a valve, and the temperature T remains constant during the experiment, calculate the following when the valve is opened:

1. The total pressure of the mixture.
2. The mole fraction.
3. The partial pressure of each gas.

Given:

- M(Ne)=20 g/molM(Ne)=20g/mol

- M(He)=4 g/molM(He)=4g/mol