University of Mujahid Abdelhafidh Boualsouf – Mila

Faculty of Science and Technology *Academic year 2025/2026*

First year the common core ST and Engineer *Module: Thermodynamics*

Series N^0 01

Exercise 01:

1-There are several units used to express the temperature of an object, the most commonly used being degrees Celsius (C°), in addition to other units such as Kelvin (K°) and Fahrenheit (F°). Convert the following temperatures to Kelvin and Fahrenheit:

-Boiling point of propane gas (-42.09 °C).

- The melting point of sodium metal is 97.72°C, and its boiling point is 883°C.

- Freezing and evaporation point of pure water.

-Find the equivalent values for the temperature on the Fahrenheit and Celsius scales.

2. Convert the following pressures to: Pa, bar, atm, torr.

-Atmospheric pressure on Mars 610 Pa.

- Atmospheric pressure in Mexico City 580 torr.

3-In standard conditions of pressure and temperature, one mole of gas occupies a volume of 22.4 litres. Write the equation for R and calculate its numerical value in the following systems: SI, l.atm $.mol^{-1}.K^{-1}$, CGS, cal$.mol^{-1}.K^{-1}$.

- What is the conversion factor from l.atm to both joules and calories?

Exercise 02:

1-Calculate the pressure that must be applied to a volume of gas measuring 220 ml at a pressure of 1 atm to reduce its volume by half at a constant temperature.

2- Calculate the mass 10 L of nitrogen gas at a temperature of (27 C°) and a pressure of (74cmHg). ***Data:*** M (N)= 14g/mol.

Exercise 03:

A gas with a mass of 3.062 g occupies a volume of 1.224 litres 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 25°C? Assume that this gas obeys the ideal gas law.

Initial status	**Final status**
$m_1 = 3.062$ 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 04:

The volumetric mass of a gas under standard conditions is 1.429 g/ml. What is its volumetric mass at 303 K and 735 mmHg?

-What is the volume of 18 g of water at 1 atm and 4°C?

Exercise 05:

A student in the laboratory filled a 250 ml container with an unknown gas until a pressure of 1 atm was obtained and found that the gas sample weighed 0.164 g. Calculate the molar mass of the gas if the temperature in the laboratory is 25°C.

Exercise 06:

A mixture consisting of 0.15 g of H_2 and 0.34 g of NH_3 at a total pressure of 1 atm and a temperature of 27°C. The mixture is considered an ideal gas. Calculate:

1- The molar fraction of each gas.

2- The partial pressure of each gas.

3- The total volume of the mixture.

Exercise 07:

A container with non-deformable walls divided into two chambers, 4 l and 2 l. Hydrogen is present in the first chamber under a pressure of 10 atm and nitrogen in the second chamber under a pressure of 7 atm. The temperature remains constant throughout the experiment. We remove the barrier between the two chambers:

1-What is the pressure in the container?
2-What are the partial pressures of the gases in the mixture and their molar fractions?

Exercise 08:

0,25 moles of an ideal gas initially exist under standard conditions at 1 atm, then are compressed until their pressure rises 5 atm and their volume decreases to a quarter.

- What is the temperature reached by 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 litres expands at a constant temperature until its volume reaches three times its initial volume. What is its final pressure?