

TD 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 cm³ of air at normal pressure ($P=1,013 \times 10^5 \text{ Pa}$).

- The end of the syringe is capped and the plunger is pushed to reduce the volume of gas to 6.0 cm³.
- 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 ($M_1=40 \text{ g.mole}^{-1}$); Kr ($M_2=84 \text{ g.mole}^{-1}$).

Exercise 04 :

A 1Kg mass of air undergoes the following transformation:

$$\text{Initial state: } \begin{cases} P_1 \approx 10^5 \text{ Pa (atmospheric pressure).} \\ V_1 \approx 0.9 \text{ m}^3 \end{cases} \quad \text{Final state: } \begin{cases} P_2 \approx 4.5 \cdot 10^5 \text{ Pa} \\ V_2 \approx ? \end{cases}$$

The transformation 1 and 2 is such that the product $P \cdot V = \text{Cste}$.

- 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: $P_1 = 10^5 \text{ Pa}$, $V_1 = 2.0 \text{ L}$ and $T_1 = 300 \text{ K}$.

- 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 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 O₂ (g), assumed to be perfect, from $2 \cdot 10^5 \text{ Pa}$ to 10^5 Pa . $M(\text{O}) = 16 \text{ g/mol}$ is given.

2) Calculate the work W carried out if the same expansion were irreversible.

3) Compare the values obtained.