

Series 1 (parte 1)

Exercise 1 :

Calculate the value of the perfect gas constant 'R'; for one mole of gas occupying a volume of 22.4L, under standard conditions ($T= 0\text{ }^{\circ}\text{C}$ and $P = 1\text{ atm}$).

Exercise 2 :

A perfect gas undergoes a transformation from state (1) to state (2) following three different paths (a, b and c) with:

The 1st transformation is isochoric then isobaric (way a), the 2nd is isobaric then isochoric (way b) and the 3rd is such that $PV=Cte$ (way c).

Condition (1): $P_1 = 1\text{ bar}$; $V_1 = 3\text{ L}$

State (2): $P_2 = 3\text{ bar}$; $V_2 = 1\text{ L}$

- 1) Represent the three transformations in Clapeyron coordinates;
- 2) Calculate the work in the three cases and deduce the heat exchanged;
- 3) Are they received or given up by the system?

Exercise 3:

One mole of perfect gas at an initial temperature of 298K expands from a pressure of 5 atmospheres to a pressure of 1 atmosphere. In each of the following cases :

1. reversible isothermal relaxation
2. reversible adiabatic relaxation
 - a) the final temperature of the gas
 - b) the variation of the internal energy of the gas
 - c) the work performed by the gas
 - d) the amount of heat involved
 - e) the enthalpy variation of the gas

Exercise 4 :

The initial state of one mole of perfect gas is characterized $p_1 = 2 \cdot 10^5\text{ Pa}$, $V_1 = 14\text{ l}$.

This gas is successively subjected to the following reversible transformations :

An isobaric trigger that doubles its volume ;

An isothermal compression that brings it back to its initial volume ;

An isochoric cooling which brings it back to the initial state.

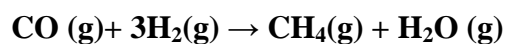
1. Determine the parameters p , V and T for each state.

2. Represent the transformation cycle on the Clapeyron diagram.
3. Calculate the work W , the heat Q and the internal energy variation ΔU corresponding to each transformation.

Data: $R = 8.31 \text{ J}/(\text{mol}\cdot\text{K})$; $c_p = 29.09 \text{ J}/(\text{mol}\cdot\text{K})$, $c_v = 20.8 \text{ J}/(\text{mol}\cdot\text{K})$

Exercise 5:

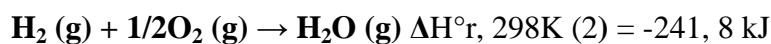
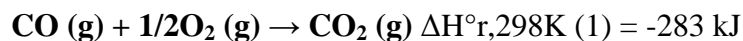
Calculate the standard enthalpy $\Delta H^\circ_{r,298\text{K}}$ of the following reaction :



a) Deduce therefrom the value of the internal energy $\Delta U^\circ_{r,298\text{K}}$ of the same reaction.

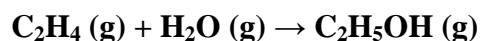
b) Is this reaction endothermic or exothermic?

The standard enthalpies of the combustion reactions $\Delta H^\circ_{r,298\text{K}}$ of CO , H_2 and CH_4 :



Exercise 6 :

Calculate the standard enthalpy $\Delta H^\circ_{r,298\text{K}}$ of the following reaction :



data : $\Delta H_f^\circ,298(\text{C}_2\text{H}_4,\text{g}) = 33,6 \text{ kJ}\cdot\text{mol}^{-1}$

$\Delta H_f^\circ,298(\text{C}_2\text{H}_5\text{OH},\text{g}) = -275,9 \text{ kJ}\cdot\text{mol}^{-1}$

$\Delta H_f^\circ,298(\text{H}_2\text{O},\text{g}) = -242,4 \text{ kJ}\cdot\text{mol}^{-1}$