University Center Abdelhafid Bousouf - Mila

Institute of Science and Technology **Subject: Thermodynamics**

First Year ST **Academic Year: 2024/2025**

Series Nº 4

Exercise 1:

Without performing calculations, deduce and discuss the sign of the entropy change for the following reactions:

1) $CH_3OH_{(l)} + {}^3/_2\, O_{2(g)} \rightarrow 2H_2O(l) + CO_{2(g)}$

2) $2H_2O(l) \rightarrow O_{2(g)} + 2H_{2(g)}$

3) $CO_{(g)} + {}^1/_2\, O_{2(g)} \rightarrow CO_{2(g)}$

4) $H_2O(l) \rightarrow H_2O(g)$

Exercise 2:

Calculate the change in entropy of acetic acid when one mole of it freezes at a pressure of 1 atm and discuss the sign of the result.

Given:

$$\Delta H_{fus(CH_3COOH)} = +69\, J.g^{-1}, \qquad T_{fus(CH_3COOH)} = 16{,}6°C$$

Exercise 3:

One mole of an ideal diatomic gas undergoes a series of reversible transformations:

1. Isochoric cooling from state A to B, where its temperature is halved.
2. Adiabatic compression to state C.
1. Isobaric heating to state D.
1. Isothermal expansion returning it to the initial state.

The table below provides the known parameters:

State	T (K)	V (L)	P (atm)
A	600	5	2
B	-	-	1
C	578	0.96	-
D	-	1	10

- Determine the unknown coordinates and represent these transformations on a Clapeyron diagram.
- Calculate the entropy change for each transformation and for the entire cycle using the data provided in the table.

Exercise 4:

1. Calculate the change in entropy for the formation of 1 mole of liquid water from its elements at 25°C and 1 atm pressure. Interpret the result.
2. Calculate the same variable for the formation of 1 mole of liquid water at 80°C and 1 atm pressure. Interpret the result.

Given:

compound	$s^{\circ}_{298}(J.K^{-1}mol^{-1})$	$Cp_{298}(J.K^{-1}mol^{-1})$
H_2	130 ,45	28,42
O_2	204,83	29,16
H_2O(l)	69,85	75,22

Assume that the heat capacity values are constant over the given temperature range.