University of Mohamed Khider, Biskra
Faculty of Exact Sciences, Natural and Life Sciences
Department: Materials Science
First Year - Common Trunk

Academic Year: 2023/2024
Course: Chemistry 2

Series N ° :2

Exercise N°1:

- We place 50g of water in a calorimeter, then measure the temperature of the mixture and find it to be 20°C. We add 50g of water at 30°C to this quantity, and observe equilibrium at 24°.
  - Determine the heat capacity C of the calorimeter.
- In the same calorimeter, we add 100g of water at 20°C and 100g of oil at 100°C. The system reaches equilibrium at 45°C.
  - Calculate the specific heat of the oil.
- In the same previous calorimeter, what will be the final temperature if we add 10g of ice (at 0°C) to 100ml of water at 40°C?

Given data:

Specific heat capacity of water Cp (H_2O; liquid) = 4200 J/Kg.K

Heat of fusion $L_{fusion;\ 273°K}$ = 334.4 J .g^{-1}

Exercise N°2:

We want to obtain 600g of water at a temperature T_f = 50°C by mixing water at a temperature of 15°C with water at a temperature of 75°C. Determine the quantity of the first and second water components.

Exercise N°3:

1- We compress reversibly, at a constant temperature of 25°C, 50g of nitrogen (N_2) under atmospheric pressure until reaching 8atm.

- Calculate the work done by the system in calorie units.

2- The system returns to its initial state irreversibly.

- Calculate the work done by the gas.
- Represent in the clapeyron diagram P = f(V) the work in both cases.

Exercise N°4:

One mole of the gas NO (considered ideal) undergoes the following reversible transformations:

1- Isothermal compression from initial state 1 to state 2.

2- Adiabatic expansion from state 2 to state 3.

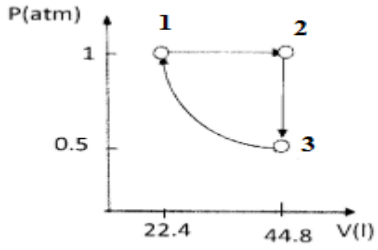
3- Heating at constant pressure returns the gas to its initial state.

- Calculate the variables V_1, V_2, V_3, and T_3 given $P_1 = P_3 = 2$ atm, $P_2 = 10$ atm, $T_1 = 300$K.
- Represent these transformations in the clapeyron diagram P = f(V).
- Calculate for each transformation and for the cycle: Q, W, ΔU, ΔH summarizing your results in a table. What do you conclude?

Given data: Cp = 5R/2; Cv = 3R/2.

Exercise N°5:

We consider 1 mole of an ideal gas undergoing a series of transformations as illustrated in the corresponding figure.



1- Provide the values of the variables (P, T, V) for each state for the cycle.

2- Determine the type of each transformation. Complete the following table, explaining the calculation method.

3- What conclusions can be drawn from the table?

Transformation	1 ⇨ 2	2 ⇨ 3	3 ⇨ 1	the cycle
Q (J)				
W (J)				
ΔU (J)				
ΔH (J)				

Given data:

R = 8.314 J.$mol^{-1}K^{-1}$; Cp = 20.08 J.$K^{-1}mol^{-1}$;

R = 0.082 l.atm.$mol^{-1}.K^{-1}$; Cv = 11.766 J.$K^{-1}mol^{-1}$