Epsilite team

Exercise 1 :

Into a lake at 17°C, an ice cube of 5 g with a temperature of 0°C is plunged. Determine:

1- The entropy variation of the ice cube.

2- The entropy variation of the lake, knowing that it acts as a thermostat.

3- The entropy variation of the universe or created entropy.

4- Is the transformation reversible? Justify your answer.

Data: c (water) = 4.18 J/g·K ; L_f = 334 J/g.

Exercise 2 : (03 pts) *(Thermometry)*

A new linear temperature scale N is constructed, in which it was chosen to assign a temperature of 100°N to melting ice and 400°N to boiling water. These two temperatures are measured under a pressure of 1 atm.

1- What is the value of the temperature 150°C in the N scale?

2- At what temperature do the Celsius and N scales give the same value?

EXERCISE 3 :

The liquid L contained in a thermometer stabilizes at a height of 5 cm from its reservoir when it is kept for a certain time in melting ice (pure solid water in equilibrium with pure liquid water, under 1 atmosphere). Moreover, if this thermometer is kept long enough in contact with pure water vapor in equilibrium with liquid water, under 1 atmosphere, the liquid L stabilizes at a height of 25 cm. Generally, it is observed that when the thermometer is immersed in a bath with a constant temperature t, after a certain time (at equilibrium) the liquid L stabilizes at a height x.

$t = a\ln(x) + b$ where t is expressed in (°C) and x in cm, a and b are constants.

a) What are the main physical phenomena related to this experiment?

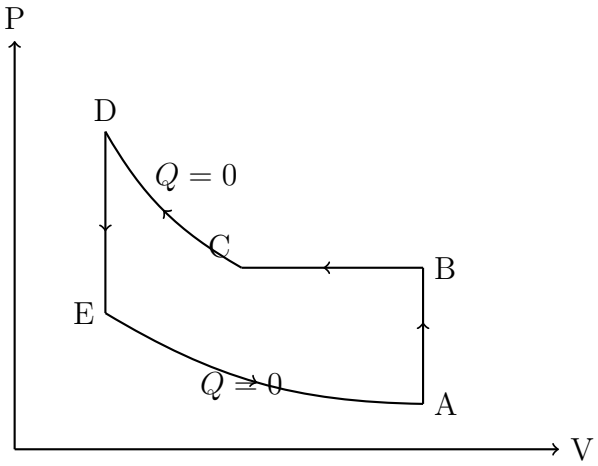
b) Determine the constants a and b.

c) Calculate the height difference between

- 0 °C and 10 °C
- 90 °C and 100 °C

Exercise 4: (07 pts) *(First and second laws)*

An ideal gas ($\gamma = \frac{5}{3}$) undergoes the reversible transformations represented on the following diagram:



1- Give the direction and the nature:

a) of each transformation.

b) of the cycle represented on this diagram.

2- Without making calculations, give only in the form of a table the positive (+), negative (-) or null (0) sign of ΔT, W, Q, ΔU, ΔH and ΔS for each of the transformations and for the cycle.

3- From the variations of the entropy of the previous transformations, deduce the expression of T_A as a function of T_B and T_C knowing that $T_D = T_B$ and $T_E = T_C$.
If $T_B = 835$ K and $T_C = 555$ K, calculate T_A.