

06G: Problem Related to the Chemical Potential

Homework Problem

1.



The gas in the above picture consists of species A (just one species). In State II the piston has moved to the right by a distance ΔL . The cross sectional area of the piston is S . Derive an expression for

$$\mu_{II}^A - \mu_I^A = ?$$

Ideal gas obeys $pV = RT$. Assume that the ambient pressure remains constant and that it is less than p_2 .

Hint: your answer should depend on p_1 , p_2 and RT .

2.

Now assume that the closed chamber contains two gas species, A and B with A having a volume fraction of 30%, and B 70%. The total pressure is p_1 in State I and p_2 in State II. Obtain the following

$$\mu_{II}^A - \mu_I^A = ?, \text{ and}$$

$$\mu_{II}^B - \mu_I^B = ?$$

3.



Now assume that the chamber is divided into two equal parts one filled with A and the other with B, both at the same pressure.

The partition is now removed in State II.

Obtain expressions for the difference in the chemical potential of the two species.

Hint: the work done on the surroundings is the difference in the chemical potential.

