Physics 112, Fall 2017: Holzapfel
Problem Set 6 (6 problems). Due Monday, October 16, 5PM

Problem 1: **Centrifuge**
Kittel 5.1

Problem 2: **Active Transport**
Kittel 5.4

Problem 3: **Carbon monoxide poisoning**
Kittel 5.8

Problem 4: **Concentration Fluctuations**
Kittel 5.10

Problem 5: **Ascent of sap in trees**
Kittel 5.12

Problem 6: **Another derivation of the chemical potential of an ideal gas**
We found in class and it is shown in the textbook that the chemical potential of an ideal gas is

$$\mu = \tau \log \frac{n}{n_Q}. \tag{1}$$

This was derived by differentiating the free energy, according to the equation

$$\mu = \left(\frac{\partial F}{\partial N}\right)_{\tau,V}. \tag{2}$$

But we also found that

$$\mu = -\tau \left(\frac{\partial \sigma}{\partial N}\right)_{U,V}. \tag{3}$$

Starting from the entropy of an ideal gas of indistinguishable particles (The Sackur-Tetrode equation) show that one reproduces equation (1) for the chemical potential of an ideal gas.