CH302H – Principles of Chemistry II: Honors
Fall 2014, Unique 51880

Homework, Week 2

1. 10 g of water at 35˚C is added to 10 g of ice at 0˚C and sealed in a thermos. Describe what happens to the system using any tools you need (i.e. words, equations, or diagrams).

2. A 4 L container with rigid walls is divided in half into two compartments separated by a rigid wall. One compartment is filled with 1.5 mol of an ideal gas, and the other is evacuated (i.e. pumped down to a vacuum of $P \sim 0$). The wall is removed and the gas expands to fill the entire vessel, while an external heater keeps the system at 25˚C.

a) Draw the initial and final states, and define the path by which the system moves between them.

b) Determine P, V, T, and n of the initial and final states.

c) Was the external heater necessary to maintain the system at this temperature? Why or why not?

3. A 1 L sample of 2.00 mol Ar gas ($C_V = 3/2\ R$, $C_P = 5/2\ R$) is expanded isothermally at 0˚C to a final volume of 5 L against a constant external pressure equal to the final pressure of the gas. Determine q, w, ΔU, and ΔH for this three process. How would this answer change if the gas expanded into a vacuum (i.e. against $P = 0$)?

4. A toy truck running 1.3 kg is run off a battery. As it partially discharges, the battery moves the truck a total of 10 m. As it does so, it heats the air around the battery compartment 5˚C. Determine q, w, and ΔU for this change, and be particularly careful with signs.

5. Many people add salt to boiling when cooking pasta. A commonly repeated statement is that this is done to raise the temperature of the water, thus decreasing cooking time. Determine how much salt would have to be added to 1 L of water to raise its boiling point by 5˚C.

6. The pressure inside a can of a typical carbonated beverage (coke, sprite, etc.) at room temperature is approximately 2.0 atm. The Henry's law constant for $CO_2(g)$ at 25˚C is 1.65 x 10^5 atm. The volume of a standard coke can is 12 fluid oz, or approximately 0.35 L.

a) What is the vapor pressure of $CO_2(g)$ inside the can?

b) What is the mole fraction of CO_2 dissolved in water under this pressure?

c) Explain what happens after the can is opened and define the new equilibrium point of the system. What is the mole fraction of CO_2 dissolved in water after the system has reached equilibrium?