CH301H – Principles of Chemistry I: Honors
Fall 2016, Unique 50015

Homework, Week 13

1. a) A sealed vessel containing an ideal gas at a pressure of 0.5 atm is opened in a room at approximately atmospheric pressure (1.0 atm). What happens?

b) A sealed vessel containing an ideal gas at a pressure of 1.5 atm is opened in the same room. What happens?

c) The pressure of a poisonous gas inside a sealed vessel is 1.47 atm at 20˚C. If the atmospheric pressure is 1.0 atm, what temperature must the container and its contents to cooled to so that the container can be opened with no risk for gas escaping?

2. You need to perform a reaction using the compound H_2Te, a colorless, odorless, highly toxic ideal gas. In order to follow basic lab safety protocols, you look up as much information about this compound as possible, and find the following piece of information on Wikipedia: "The weight of one liter of $H_2Te(g)$ is 6.234 g."

a) Is there any value in this information whatsoever?

b) At what temperature is this statement true, if the gas is at 1.0 atm?

3. Research in surface science is carried out using ultra-high vacuum chambers that can sustain pressures as low as 10^{-12} Torr. How many molecules are there in a 1.00 cm^3 volume inside such an apparatus at 298 K? What is the corresponding molar volume at this temperature and pressure? Assume the gas is ideal.

4. The van der Waals equation is a state function that can be used to describe a non-ideal gas. Use the ideal and van der Waals state functions to determine the pressure of 1 mole of ethane (C_2H_6) gas under the following conditions, and comment on any differences.

a) In a container of volume 22.4 L at 273.15 K.

b) In a container of volume 0.100 L at 1000 K.