CHEM 105 – Dr. Lammi Name:_____

Quiz 5 – Take-Home – Due by start of class on Wed., Oct. 16, 2019

You <u>may</u> use your textbook and your lecture notes. You <u>may NOT</u> seek help from other people.

Useful Information: $PV = nRT$ $R = 0.08206 \frac{L \cdot atm}{mol \cdot K}$ $P_A = \chi_A P_{total}$ $\chi_A = \frac{n_A}{n_{total}}$

$\overline{E_K} = \frac{3}{2}RT$ $v_{rms} = \sqrt{\frac{3RT}{M}}$ $1\ L = 1000\ cm^3 = 0.001\ m^3$ $1\ atm = 760\ Torr = 760\ mm\ Hg$

1. Suppose that you perform a chemical reaction that produces toxic hydrogen cyanide (HCN) gas, which you collect in a sealed 1.5-L flask and allow to cool to room temperature.

   a. If the pressure of HCN in the flask is 215 Torr at 22.5 °C, how many **milligrams** of HCN does the flask contain?

   b. Suppose that the flask breaks, releasing all of the HCN into the (enclosed) room. If the room volume is 75 m^3, **what is the new gas pressure**?

   c. Due to the risk of thyroid, blood, and respiratory effects, the National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit for HCN of 5 $\frac{mg}{m^3}$. Would your exposure exceed this limit? (Be sure to show your work.)

<u>Quiz continues on reverse side</u>

2. Suppose that you fill a tire with air to a pressure of 36.7 psi (pounds per square inch; 1 atm = 14.70 psi) when the temperature is 22.1 °C.

    a. Nitrogen (N_2), oxygen (O_2) and argon (Ar) are the most prevalent gases in air. If the mole fraction of N_2 in the mixture is 0.79, what is the **partial pressure of N_2** in the tire?

    b. How do the **average kinetic energies** of the nitrogen and oxygen molecules compare? **Explain** in a few words.

    c. Which of the three gases in the mixture has particles moving at the **fastest average speed,** nitrogen, oxygen, or argon? **Explain** briefly.

(Lots of extra space here!)