Quiz 1.1 – An Ideal Gas

Name: _____

Question 1

A weather balloon starts in Cedar City with with $P = 0.82\ atm$, $T = 21.5\ °C$, and $V = 18.75\ L$

- Find the number of moles of gas inside the balloon
- If the balloon is filled with He gas, find the mass of the gas inside the balloon
- Find the density of the He-filled balloon (assume the instruments and balloon itself have no mass)
- Find the density of the surrounding air (assume it is 100% N_2 gas)

Question 2

The weather balloon is released into the upper atmosphere and the instruments on-board indicate a pressure of $0.45\ atm$ and a temperature of $-32.4\ °C$

What will the new volume of the balloon be?

Question 3

A car engine burns about $0.1\ g$ of gasoline (C_8H_{18})for each engine cycle. A car engine may have a cylinder volume of $0.075\ L$ at the point of ignition, and operate at a temperature of $80.0\ °C$. If the gasoline combusts completely inside the $0.075\ L$ piston, what is the pressure of the combustion products?

Question 4

Find the following, regarding a sample of pure Helium at $25°C$ and $0.800\ atm$

- v_{rms}
- v_{rel}
- Collision frequency
- λ (mean free path)

Question 5

What will be v_{rel} for collisions between O_2 and N_2 molecules in a sample of the atmosphere at $25°C$ and $0.800\ atm$ $\left(\chi_{N_2} = 0.80,\ \chi_{O_2} = 0.20\right)$

When I Heard the Learn'd Astronomer

By Walt Whitman

When I heard the learn'd astronomer,
When the proofs, the figures, were ranged in columns before me,
When I was shown the charts and diagrams, to add, divide, and measure them,
When I sitting heard the astronomer where he lectured with much applause in the lecture-room,
How soon unaccountable I became tired and sick,
Till rising and gliding out I wander'd off by myself,
In the mystical moist night-air, and from time to time,
Look'd up in perfect silence at the stars.