

## Quiz 1.1 – An Ideal Gas

Name: \_\_\_\_\_

**Question 1**

A weather balloon starts in Cedar City with with  $P = 0.82 \text{ atm}$ ,  $T = 21.5^\circ\text{C}$ , and  $V = 18.75 \text{ L}$

- 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%  $\text{N}_2$  gas)

**Question 2**

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

What will the new volume of the balloon be?

**Question 3**

A car engine burns about  $0.1 \text{ g}$  of gasoline ( $\text{C}_8\text{H}_{18}$ ) for each engine cycle. A car engine may have a cylinder volume of  $0.075 \text{ L}$  at the point of ignition, and operate at a temperature of  $80.0^\circ\text{C}$ . If the gasoline combusts completely inside the  $0.075 \text{ L}$  piston, what is the pressure of the combustion products?

**Question 4**

Find the following, regarding a sample of pure Helium at  $25^{\circ}\text{C}$  and  $0.800\text{ atm}$

- $v_{rms}$
- $v_{rel}$
- $\lambda$  (mean free path)
- Collision frequency

**Question 5**

What will be  $v_{rel}$  for collisions between  $\text{O}_2$  and  $\text{N}_2$  molecules in a sample of the atmosphere at  $25^{\circ}\text{C}$  and  $0.800\text{ atm}$  ( $\chi_{\text{N}_2} = 0.80$ ,  $\chi_{\text{O}_2} = 0.20$ )

***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.