
PHYS 1220 Group Work Sheet

Ideal Gas

With your group, discuss how to answer these questions and write your group answer in the space provided. Explain/show how you got your answer: don't just write down a number! (Especially not one without units!)

Some useful quantities:

Avogadro's number $N_A = 6.0221 \times 10^{23}$

Boltzmann Constant $k_B = 1.380649 \times 10^{-23} \text{ J/K}$

Universal Gas constant $R = N_A k_B = 8.31446 \text{ J/(mol}\cdot\text{K)}$

1. A sample of n moles of an ideal gas at temperature T_1 and pressure p_1 is held in a rigid container of volume V .
 - a. If the average speed of the gas molecules is doubled:
 - i. What is the new temperature T_2 in terms of T_1 ?

 - ii. What is the new pressure p_2 in terms of p_1 ?

 - b. How much energy is required to double the average speed of the gas molecules? Express in terms of T_1 and in terms of $p_1 V$.

2. What is the total translational kinetic energy of the air in an empty room that has dimensions $5.00 \text{ m} \times 4.00 \text{ m} \times 3.00 \text{ m}$ at $T = 300\text{K}$ and $p = 1.00 \text{ atm}$?

3. At 300K, what is the rms speed of:

a. Oxygen molecules?

b. Nitrogen molecules?

c. Argon atoms?