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 $k_B = 1.380649 \times 10^{-23}$ J/K
Universal Gas constant $R = N_A\, k_B = 8.31446$ J/(mol·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_1V.

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

3. At 300K, what is the rms speed of:
    a. Oxygen molecules?

    b. Nitrogen molecules?

    c. Argon atoms?