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**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  $R = 8.31446$  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  $pV_1$ .

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?