Outline for Today
Wednesday, Oct. 17

- Chapter 10: Gases
  - Physical Properties of Gases
  - Ideal Gas Law
  - Partial Pressures

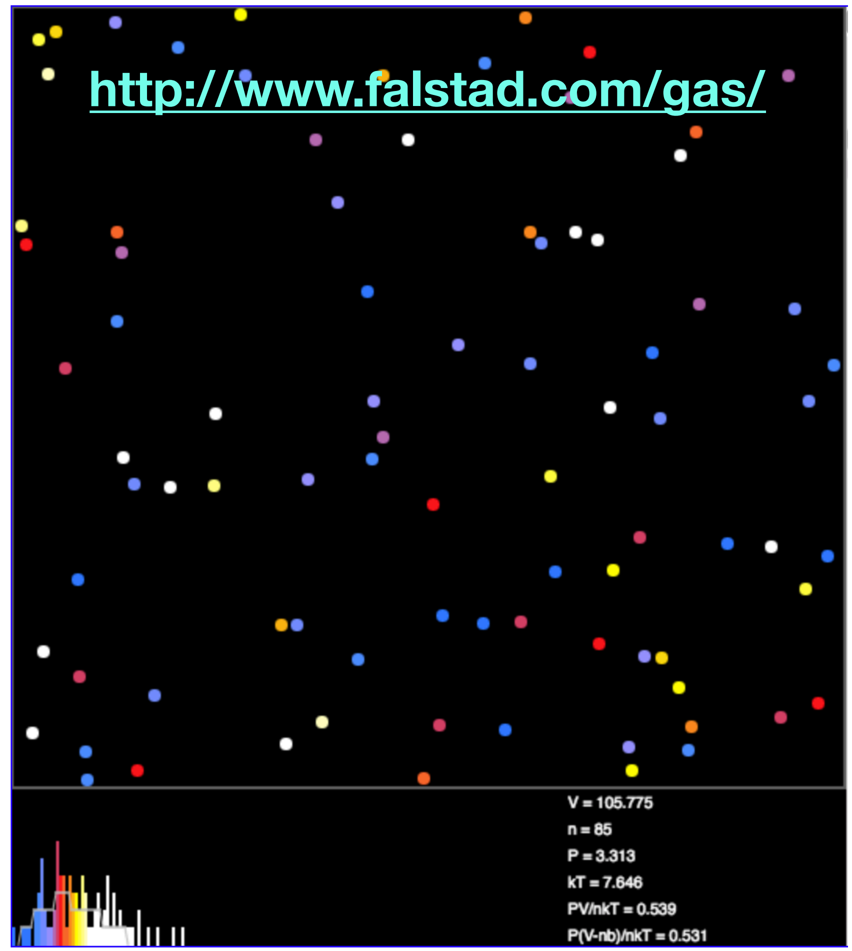
What are Some Properties of Gases?

- In groups of 2-3 people, come up with a list of **3 properties of gases.**
- On your index card:
    - **Your Name** *and names of group members*
    - List **3 properties of gases**

What are Some Properties of Gases?

- **Similar physical properties**
- **Make homogeneous mixtures**
- **Fill the volume both their containers,**
  - **but most of the volume is empty space.**
- **Highly compressible.**
- **Follow the Ideal Gas Equation:**

$$PV=nRT$$



Our Model of **Ideal Gases** is based on the **Kinetic Molecular Theory of Gases**

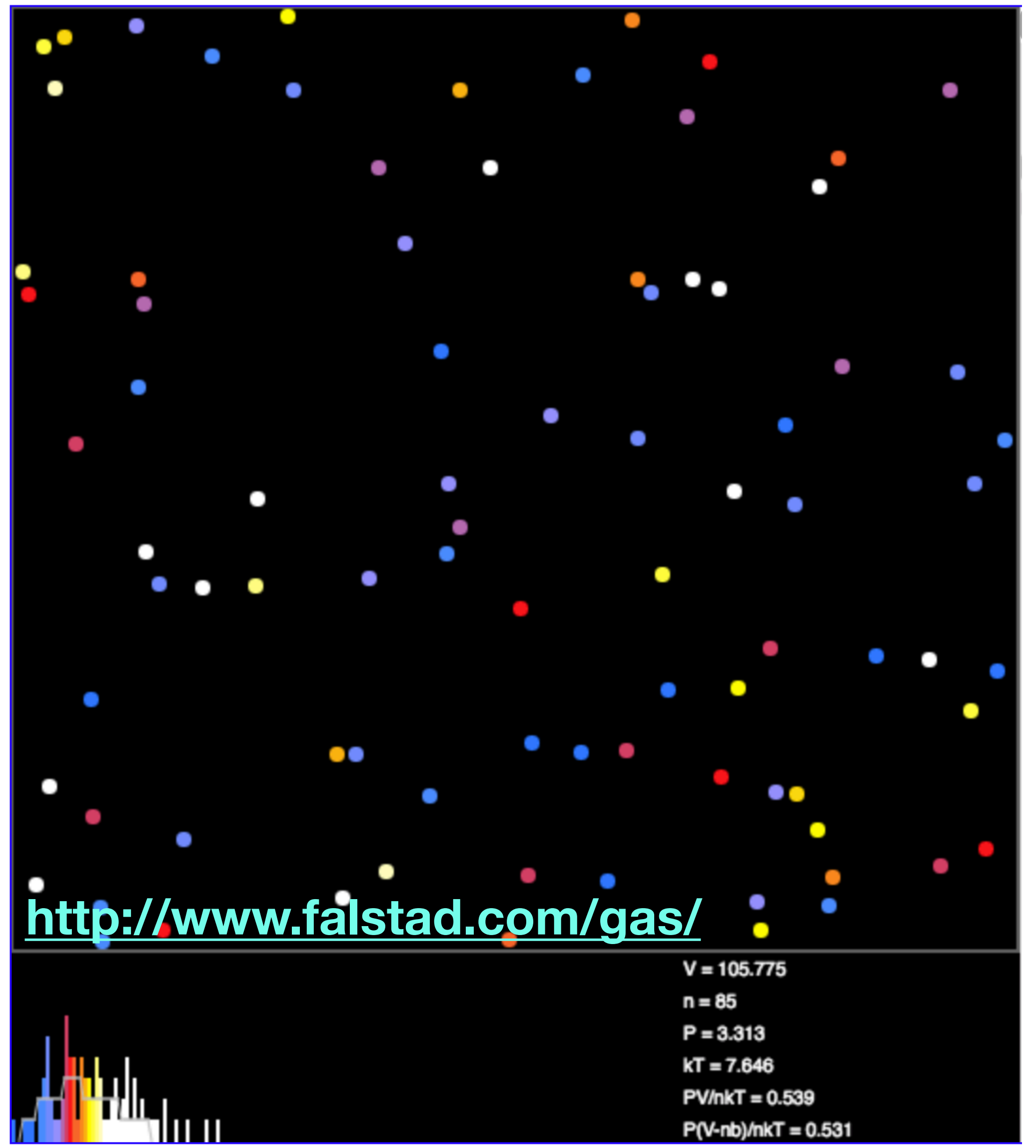
1. Volume of gas *molecules* are negligible.

2. Gas molecules neither attract nor repel each other.

3. They have completely elastic collisions with each other.

4. Molecules move in continuous random motion.

5. Average kinetic energy (motion) is proportional to temperature.



On your index card

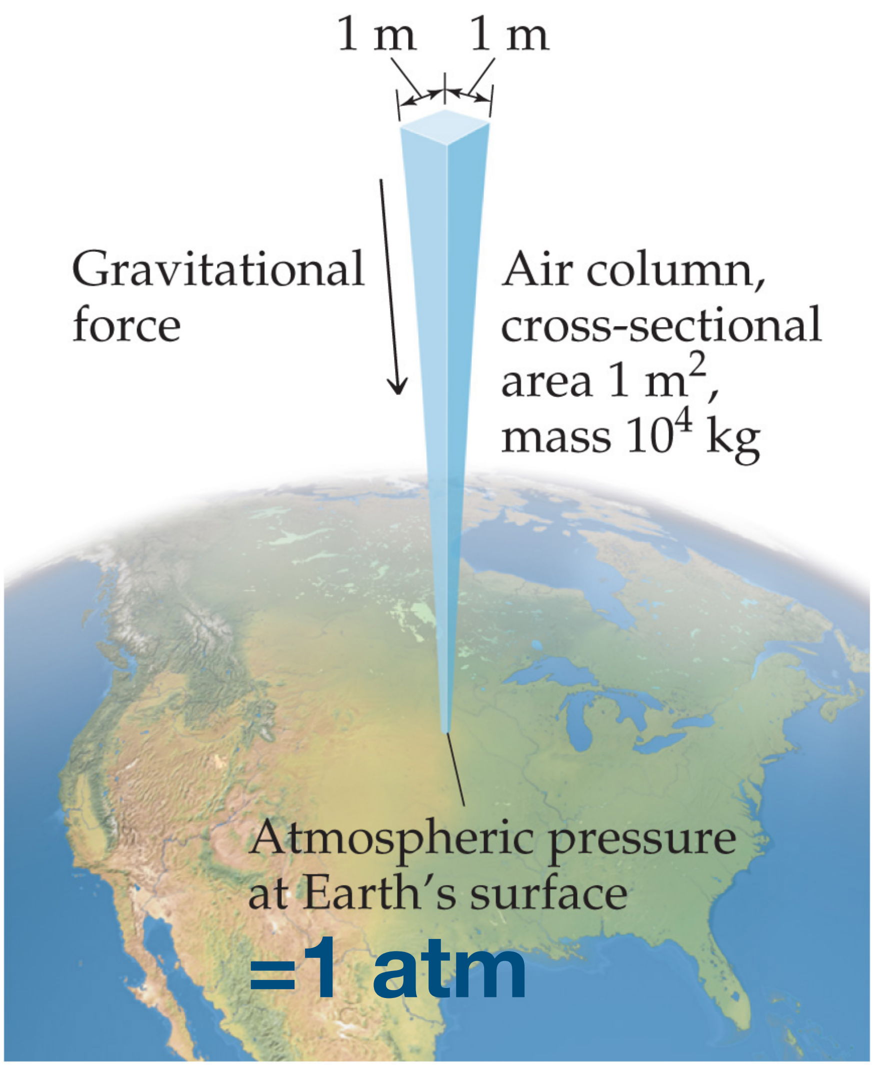
- On your index card, write down one one question your group has about the simulator or the Kinetic Molecular Theory of Gases.

What are the Macroscopic Properties of Ideal Gases?

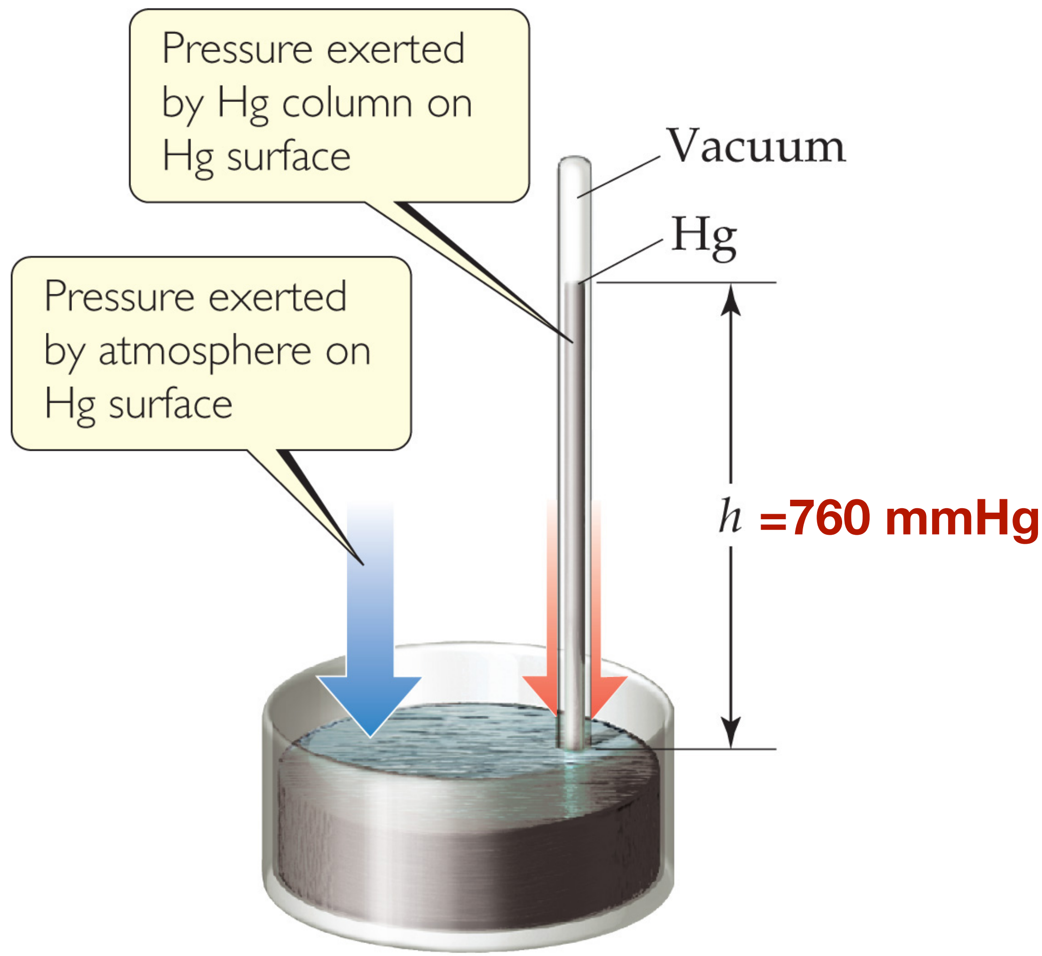
- **Similar physical properties**
- **Make homogeneous mixtures**
- **Fill the volume both their containers,**
  - **but most of the volume is empty space.**
- **Highly compressible.**
- **Follow the Ideal Gas Equation:**

$$PV=nRT$$

Pressure



1 m
1 m
Gravitational force
Air column, cross-sectional area 1 m^2, mass 10^4 kg
Atmospheric pressure at Earth's surface
=1 atm



Pressure exerted by Hg column on Hg surface
Vacuum
Hg
Pressure exerted by atmosphere on Hg surface
h =760 mmHg

Example: Ideal Gas Equation

- Tennis balls are filled with N_2 (g) at pressures higher than atmospheric pressure to increase their bounce. If a tennis ball has a **volume of 144 cm^3** and contains **0.33 g N_2,** what is the **pressure** at **24^o C**?

Example: Initial and Final Conditions

- Soda cans are filled so that the pressure of the small amount of gas in the can is **250 kPa** at **20^{o}C.** If my can of soda exploded at **150 ^{o}C**, at what pressure did the can fail (explode)?

  - How does that compare to the industry standard of handling pressures up to **6 atm**?

Example: Density of Gases

- Which is more dense? CO_2 or air (80% N_2 and 20% O_2)?
- What is the density of CO_2 at STP?
- What is the density of air at STP?

Example: Using the Ideal Gas Equation in a Stoichiometry Problem

- In Andy Weir's *The Martian,* the astronaut Mark Watney finds himself in a situation where he needs to make water from H_2 and O_2 gases. **How many L of H_2(g) and O_2 (g)** does he need to make **1.0 L of liquid water** (**density = 0.997 g/mL**)? Pressure in H_2 and O_2 tanks is **5.0 atm** and the temperature inside the station is **20 ^oC**.

Example: Partial Pressures and Reactions

- A Chemist is studying O_3 formation in the troposphere. In her 100.0 L reaction container she has a mixture of CO, O_2 and N_2. She is studying the reaction:

  - $CO\ (g) + 2O_2\ (g) \rightarrow CO_2\ (g) + O_3\ (g)$

- The partial pressures at 25 ^oC are:

  P_{CO} = 0.10 atm

  P_{O_2} = 0.20 atm

  P_{N_2} =0.80 atm

- What are the **final partial pressures** of all of the molecules after the reaction?