

Class 4.1
Introduction to Gases

CHEM 107
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Reminders

- ◆ EXAM #1 is Wed., 2/10, 7:30 PM, in HELD 100
- ◆ Exam help session, Mon., 2/8, 7 PM, in HELD 200
- ◆ Lab this week is Expt. #3
- ◆ Also, pick up problem set #3 in lab

- ◆ We will finish the phosphate problem from Friday's class first.

Ideal Gases

- ◆ Gas Law:

$$PV = nRT$$

- ◆ Originally based on empirical observations
- ◆ Can also be derived mathematically from the kinetic theory of gases

Pressure

- ◆ Dimensions of force/area
- ◆ SI unit is N/m^2 , or Pascals
- ◆ Other more common units:
 - atmospheres:
 $1 \text{ atm} = 101,325 \text{ Pa}$
 - torr (mm Hg):
 $760 \text{ torr} = 1 \text{ atm}$
 - lbs/in²:
 $14.7 \text{ psi} = 1 \text{ atm}$

Gas Constant - R

- ◆ proportionality constant, found by experiment
- ◆ In SI units:
 $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$
- ◆ Other units:
 $R = 0.08206 \text{ L atm mol}^{-1} \text{ K}^{-1}$
 $= 62.36 \text{ L torr mol}^{-1} \text{ K}^{-1}$

Units

- ◆ Consistent units are ALWAYS required!
- ◆ Use any convenient units for P, V
- ◆ MUST use absolute T (Kelvin, NOT °C)
 $0^{\circ}\text{C} = 273\text{ K}$

- ◆ I will do several experiments to demonstrate the relationships contained in the ideal gas equation.

What makes a gas "ideal?"

☛ "Think Molecules"

Ideal Gas: Definition

- ◆ According to our text:

"An ideal gas is defined as one for which both the volume of the molecules and the forces between the molecules are so small that they have no effect on the behavior of the gas."

Properties of an Ideal Gas

- ◆ Huge # of molecules
- ◆ Point masses, no volume
- ◆ No forces between molecules
- ◆ Constant, chaotic motion
- ◆ Elastic collisions

Gas Law = Limiting Case

- ◆ Any gas will behave ideally in the limits of
LOW PRESSURE
HIGH TEMPERATURE
- ◆ Explain this in terms of previous definition & properties?

Applicability of Ideal Gas Law

- ◆ OK for most gases at ordinary T, P
- ◆ MUST fail at some point, since solids and liquids exist.
- ◆ Deviations at high P, low T.

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