Chapter 5—Gases

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After this chapter, you should be able to…

- Summarize the key physical properties of a gas
- Recall the formulas of the gaseous elements
- ~~Explain the difference between a gas and a vapor~~
- Explain what is meant by *pressure* in terms of the behavior of the molecules
- State the SI unit of pressure
- Explain how atmospheric pressure can be measured using a Toricelli barometer
    - Recall the relationship between the units of pressure: atm, mmHg, Pa, and torr
    - Convert pressures from one set of units to another
- State and explain Boyles law
    - Use Boyles law in a pressure-volume calculation
- State and explain Charles' law
    - Use Charles' law in a volume-temperature calculation
    - Explain how absolute zero is determined, and the relationship between the absolute temperature scale and the Celcius temperature scale
- State and explain Avogadro's law
    - Use Avogadro's law in a number-of-moles–volume calculation
- State and explain the ideal(perfect) gas law
    - Recognize that the ideal(perfect) gas constant, R, has a numerical value that depends upon the associated units
    - Explain what is meant by STP
    - Use the ideal gas law to perform a P-V-n-T calculation
- Derive the relationship between gas density and molar mass using the ideal gas law
    - Calculate a molar-mass given a gas density (and vice versa)
- Use the gas-laws to calculate the number of moles, or volume of a gas produced in a chemical reaction
- State and explain Dalton's law of partial pressures
    - Explain what is meant by the mole fraction of a gas
    - Calculate the partial pressure, mole fractions, or total pressure of a mixture of gases given their amounts, temperature, and volume of the container

- Give a short account of the Kinetic Molecular Theory (KMT) of gases
  - Recall the fundamental postulates of KMT
  - Explain what is meant by thermal motion, and how temperature is related to average kinetic energy
  - Sketch molecular speed distributions for gases, clearly showing how they vary with varying temperature/molecular weight
  - Calculate the rms-speed of a gas molecule, given the temperature of the gas
- Explain why *real* gases deviate from ideal behavior
- State and explain the van der Waals equation, and how the terms *a* and *b* relate to the non-ideal behavior of the molecules
  - Given *a* and *b*, calculate the pressure of a specified gas using the van der Waals equation

Make sure you can solve all the assigned end-of-chapter homework problems!

Also:
• be able to describe gas diffusion, and gas effusion
• From ratios of gas diffusion/effusion studies, be able to calculate the molar mass of an unknown gas.