# 2.S: Gases (Summary)

## Learning Objectives

After mastering the material covered in this chapter, one will be able to:

1. Understand the relationships demonstrated by and perform calculations using the empirical gas laws (Boyle's Law, Charles' Law, Gay-Lussac's Law, and Avogadro's Law, as well as the combined gas law.)
2. Understand and be able to utilize the ideal gas law in applications important in chemistry.
3. State the postulates of the Kinetic Molecular theory of gases.
4. Utilize the Maxwell and Maxwell-Boltzmann distributions to describe the relationship between temperature and the distribution of molecular speeds.
5. Derive an expression for pressure based on the predictions of the kinetic molecular theory for the collisions of gas molecules with the walls of a container.
6. Derive and utilize an expression for the frequency with which molecules in a gas sample collide with other molecules.
7. Derive and utilize an expression for the mean-free-path of molecules based on temperature, pressure, and collisional cross section.
8. Explain how the van der Waals (and other) model(s) allow for deviations from ideal behavior of gas samples.
9. Derive an expression for the Boyle temperature and interpret the results based on how a gas's behavior approaches that of an ideal gas.
10. Explain and utilize the Principle of Corresponding States.

## Vocabulary and Concepts

- average
- Boyle temperature
- collisional cross section
- compression factor
- critical point
- critical temperature
- diffusion
- effusion
- empirical
- empirical gas laws
- frequency of collisions
- frequency of collisions with the wall
- gas law constant
- ideal gas law
- intermolecular potential
- isotherm
- Kinetic Molecular Theory
- Knudsen cell
- Leonard-Jones potential
- maximum probability
- Maxwell's distribution
- Maxwell-Boltzmann distribution
- mean free path
- normalization constant
- number density
- principle of corresponding states
- reduced variables
- root-mean-square
- Second Virial Coefficient
- Taylor Series Expansion

- van der Waals' equation
- Virial Equation

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