

10: Gases

OVERVIEW OF THE CHAPTER

10.1, 10.2 Properties and Characteristics of Gases

Review: States of matter (1.2); dimensional analysis (1.6)

Learning Goals: You should be able to:

1. Describe the general characteristics of gases as compared to other states of matter, and list the ways in which gases are distinct.
2. Define atmosphere, torr, and pascal, the most important units in which pressure is expressed. Also describe how a barometer and manometer work.

10.3, 10.4, 10.5 Using the Gas Laws: Solving

Review: Density (1.4); temperature (1.4); mole (3.4); stoichiometry (3.1, 3.6).

Learning Goals: You should be able to:

1. Describe how a gas responds to changes in pressure, volume, temperature, and quantity of gas.
2. Use the gas laws, including the combined gas law, to calculate how one variable of a gas (P, V, n, or T) responds to changes in one or more of the other variables.
3. Use the ideal-gas equation to solve for one variable (P, V, n, or T), given the other three variables or information from which they can be determined.
4. Calculate the molar mass of a gas, given gas density under specified conditions of temperature and pressure. Also calculate gas density under stated conditions.

10.6 Dalton's Law of Partial Pressures: Mixture of Gases

Learning Goals: You should be able to:

1. Calculate the partial pressure of any gas in a mixture, given the composition of that mixture.
2. Calculate the mole fraction of a gas in a mixture, given its partial pressure and the total pressure of the system.

10.7, 10.8 The Kinetic-Molecular Theory of Gases: Molecular Speeds and Effusion

Review: Molecules (2.6); kinetic energy (6.1)

Learning Goals: You should be able to:

1. Describe how the distribution of speeds and the average speed of gas molecules change with temperature.
2. Describe how the relative rates of effusion and diffusion of two gases depend on their molar masses (Graham's law).
3. Use the principles of the kinetic-molecular theory of gases to explain the nature of gas pressure and temperature at the molecular level.

10.9

Departures from Ideal-Gas Behavior

Learning Goals: You should be able to:

1. Explain the origin of deviations shown by real gases from the relationship $PV/RT = 1$ for one mole of an ideal gas.
2. Cite the general conditions of P and T under which real gases most closely approximate ideal-gas behavior.
3. Explain the origins of the correction terms to P and V that appear in the van der Waals equation.