

CHAPTER OVERVIEW

2: Gas Laws

Early experimenters discovered that the pressure, volume, and temperature of a gas are related by simple equations. The classical gas laws include **Boyle's law**, **Charles' law**, **Avogadro's hypothesis**, **Dalton's law of partial pressures**, and **Amagat's law of partial volumes**. These laws were inferred from experiments done at relatively low pressures and at temperatures well above those at which the gases could be liquefied. We begin our discussion of gas laws by reviewing the experimental results that are obtained under such conditions. As we extend our experiments to conditions in which gas densities are greater, we find that the accuracy of the classical gas laws decreases.

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[2.2: Charles' Law](#)

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¹ We use the over-bar to indicate that the quantity is per mole of substance. Thus, we write \bar{N} to indicate the number of particles per mole. We write \bar{M} to represent the gram molar mass. In Chapter 14, we introduce the use of the over-bar to denote a partial molar quantity; this is consistent with the usage introduced here, but carries the further qualification that temperature and pressure are constant at specified values. We also use the over-bar to indicate the arithmetic average; such instances will be clear from the context.

² The unit of temperature is named the kelvin, which is abbreviated as K.

³ A redefinition of the size of the unit of temperature, the kelvin, is under consideration. The practical effect will be inconsequential for any but the most exacting of measurements.

⁴ For a thorough discussion of the development of the concept of temperature, the evolution of our means to measure it, and the philosophical considerations involved, see Hasok Chang, *Inventing Temperature*, Oxford University Press, 2004.

⁵ See T. L. Hill, *An Introduction to Statistical Thermodynamics*, Addison-Wesley Publishing Company, 1960, p 286.

⁶ See S. M. Blinder, *Advanced Physical Chemistry*, The Macmillan Company, Collier-Macmillan Canada, Ltd., Toronto, 1969, pp 185-18926

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