CHAPTER 1: THE PROPERTIES OF GASES
CHAPTER OUTLINE

HW: Questions are below. Solutions are in separate file on the course web site.

Sect. **Material**

1. SI Units (and the pressure of gases)
2. Atomic and Molecular weight
3. The Mole (and mass-mole-molecule-atom conversions)
4. The Gas Laws
5. The Perfect Gas Law
6. Alternative Form of the Perfect Gas Equation
7. Molar Mass from Gas Phase Density
8. Mixtures of Gases: Dalton's Law
9. Kinetic Theory of Gases
10. Diffusion and Effusion
11. Real Gases
12. Vapor Pressure, Liquifaction and the Critical Point

Chapter 1 Homework

1.1 (a) How many grams of $Mg(NO_3)_2$ [M = 148.3] contain $4.5x10^{23}$ atoms of oxygen?
(b) How many atoms are contained in 50 grams of octane, C_8H_{18} [M = 114]?

1.2 A sample of $CO_2(g)$ is in a 7.5 L container at -15 ^oC and 142 torr pressure.
(a) How many grams of $CO_2(g)$ are in the container?
(b) How many molecules are in the container

1.3 A sample of neon of mass 255 mg occupies 3.00 L at 122 K. What pressure does it exert? (in torr)

1.4 Nitrogen Monoxide (NO) has been found to act as a neurotransmitter. To prepare to study its effect, a sample was collected in a container of volume 250 cm^3. At 19.5 ^oC, its pressure is found to be 24.5 kPa. How many moles of NO have been collected.

1.5 You are warned not to dispose of pressurized cans by throwing them onto a fire. The gas in an aerosol container exters a pressure of 125 kPa at 18 ^oC. The container is thrown onto a fire, and its temperature rises to 700 ^oC. What is the pressure at this temperature?

1.6 To what temperature must a sample of helium gas be cooled from 22.2 ^oC to reduce its volume from 1.00 L to 100. cm^3?

1.7 At sea level, where the pressure was 104 kPa and the temperatrure 21.1 ^oC, a sample of air occupied 2.0 m^3. To what volume will the sample expand when it has risen to an altitude where the pressure and temperature are:
(a) 52 kPa , -5.0 ^oC
(b) 880 Pa , -52.0 ^oC

1.8 A meterological baloon had a radius of 1.0 m when released at sea level and 20 ^oC. It expanded to a radius of 3.0 m when it had risen to its maximum altitude where the temperature was -20 ^oC. What is the pressure inside the baloon at that altitude?

Note: The volume of a sphere is related to its radius by: $V = \frac{4}{3}\pi R^3$

1.9 A gas evolved during the fermentation of glucose has a volume of 0.78 L when measured at 21 ^oC and 1.0 bar. What is the volume of this gas at the fermentation `temperature of 37 ^oC and 0.87 bar?

1.10 In an experiment to measure the molar mass of a gas, 250 cm^3 of the gas was confined in a glass vessel. The pressure was 152 torr at 298 K and the mass of the gas was 33.5 mg. What is the molar mass of the gas?

1.11 A container holds two gases, He [M=4] and Ar [M=40], and is 15% He. If the total pressure is 4.0 bar and temperature is 50 ^{o}C, calculate

(a) The partial pressure of each gas (in bar and kPa)

(b) The Molar concentration of each gas, in mol/L.

1.12 An inflammable gas is generated in marsh lands and sewage by a certain anaerobic bacterium culture. A pure sample of this gas was found to effuse through a pin hole in 12.6 minutes. Under the same conditions, it takes oxygen gas 17.8 minutes to effuse through the same pinhole. Calculate the molar mass of this gas and suggest what the gas might be.

1.13 The RMS average speed of nitrogen molecules is 515 m/s at 25 ^{o}C.

(a) What is the RMS average speed of hydrogen molecules at the same temperature?

(b) What is the RMS average speed of nitrogen molecules at 1200 ^{o}C?