Chapter 14 – Gas Laws **Notes & Practice Problems**

Boyle's Law (section 14.2)

Describe Boyle's Law:

Is this a direct or indirect relationship? _____ this means…

What is the formula for Boyle's Law?

List acceptable units for each variable in Boyle's Law…P:

V:

Solve

1. Calculate the final pressure in a cylinder of a car engine if the original volume was 450.0 mL at a pressure of 101.3 kPa and the final volume is 120.0 mL. Assume no change in the number of molecules or temperature.
2. The volume of a gas is 250.0 mL at 3.50 atm pressure. What will the volume be when the pressure is reduced to 0.750 atm?
3. Additional chapter questions: 7, 8, 20, 47, 48

Charles' Law (section 14.2)

Describe Charles' Law:

Is this a direct or indirect relationship? _____ this means…

What is the formula for Charles' Law?

List acceptable units for each variable in Charles' Law…V:

T:

Solve

1. A helium balloon inflated in an air-conditioned store at 27.0°C has a volume of 4.00 liters. When the balloon is taken outside, the temperature is 40.0°C. What is the new volume?
2. The gas inside a piston was heated until the volume of gas had increased from 125.0 mL to 850.0 mL. If the temperature inside the piston was originally 15.0°C, calculate the new temperature. The amount of gas and the pressure do not change.
3. Additional chapter questions: 9, 10, 49

Gay-Lussac's Law (section 14.2)

Describe Gay-Lussac's Law:

Is this a direct or indirect relationship? _____ this means…

What is the formula for Gay-Lussac's Law?

List acceptable units for each variable in Gay-Lussac's…T:

P:

Solve

1. The propellant gas left in an "empty" aerosol can is at atmospheric pressure, 101.3 kPa and room temperature, 23.0°C. If the can is thrown into a fire where the temperature of the gas reaches 927°C, what is the pressure in the can?
2. A certain gas is held in a storage tank at a pressure of 50.0 atm and a temperature of 23.0°C. There is a small metal safety plug, designed to melt at high temperatures in order to relieve dangerously high pressure. If the pressure inside the tank reaches 75.0 atm, the plug will melt. What is the temperature at this pressure?
3. Additional chapter questions: 11, 12, 46, 51

Combined Gas Law (section 14.2)

What is meant by the "combined" gas law?

Write the formula for the Combined Gas Law.

Solve

1. At sea level the volume of a hot air balloon is 1.00×10^5 liters. The pressure is 760.0 mm of Hg and the temperature is 25.0°C. At an altitude of 6.00 km, the pressure is 350.0 mm of Hg, and the temperature is -23°C. What is the volume of the balloon at this altitude?
2. Determine the temperature required to change 10.0 liters of helium at -100.0°C and 0.100 atm to 20.0 liters at 1.70 atm. Rewrite the final answer in °C.
3. Additional chapter questions: 13, 15, 22

Real vs. Ideal Gases (section 14.3)

We live in a world of _____ (real or ideal) gases. Under conditions of _____(low or high) pressures and _____(low or high) temperatures gases will condense to liquids. In addition, real gas molecules _____(have or have no) volume of their own. This is contrary to the concept of an ideal gas, which follows the gas laws at **all** conditions of temperature and pressure, and assumes that gas molecules occupy no space of their own. However, under most conditions of temperature and pressure, real gases do behave like ideal gases.

Ideal Gas Law (section 14.3)

Write the formula for the Ideal Gas Law.

The Ideal Gas Law is a modification of the Combined Gas Law. Describe the modification.

If P, V, n and T are considered to represent exactly 1 mole of gas at STP, calculate the value of PV/nT. Be sure to include the appropriate units.

Solve

1. A 47.3 L container containing 1.62 mol of He is heated until the pressure reaches 1.85 atm. What is the temperature?
2. When a rigid hollow sphere containing 680.0 L of helium gas is heated to 600.0 K, the pressure of the gas increases to 1800.0 kPa. How many moles of helium gas are present?
3. Additional chapter questions: 23, 24, 53, 55, 56, 57, 58

Dalton's Law of Partial Pressures (section 14.4)

Define "partial pressure"

Write the formula of Dalton's Law of partial pressures.

Solve

1. A mixture of gases at total pressure 120 kPa contains N_2, CO_2, and O_2. The partial pressure of the nitrogen is 43 kPa and the partial pressure of the CO_2 is 34 kPa. What is the partial pressure of the O_2?
2. Chapter questions: 31, 32, 35

Avogadro's Hypothesis

Recall earlier references to STP, moles and number of molecules and volume. What is the molar volume of oxygen gas at STP?

How many molecules would be present?

What would the mass of the gas be at these conditions?