

Exercise 11.1b(H)

Partial Pressures

Name: _____

Date: _____ Per: _____

In any mixture of gases, the partial pressures of the gases will be proportional to their quantities measured in moles. The gases act independently of one another, so their collisions (pressure) is simply a function of how many particles are present at a constant temperature and pressure. For example, in a mixture of two gasses A & B, if gas A exerts 2 atm of pressure and gas B exerts 1 atm of pressure, there must be twice as many particles of A to cause twice the collisions caused by gas B.

A mole fraction (X) is a ratio that compares the number of moles (n) of a particular part of a mixture to the total number of moles of the mixture (n_{tot}).

$$X_A = \frac{n_A}{n_{\text{tot}}} = \frac{n_A}{n_A + n_B + n_C \dots}$$

The sum of the mole fractions of all the components present must equal 1. The amount of gas present in a mixture may be described by its partial pressure or its mole fraction. In a mixture of gases, the partial pressure of each gas is the product of the total pressure and the mole fraction of that gas.

$$\frac{P_A}{P_{\text{tot}}} = \frac{n_A}{n_{\text{tot}}} = X_A \text{ or rearranging the equation } P_A = (X_A)(P_{\text{tot}})$$

DIRECTIONS: Complete the following in the space provided.

Pressure Unit Equivalences

1.00 atm = 760 mm Hg	1.00 atm = 1013 mbars
1.00 atm = 14.7 psi	1.00 atm = 760 Torr
1.00 atm = 101 325 Pa	1.00 atm = 29.92 in Hg
1.00 atm = 101.325 kPa	1.00 atm = 407 in. H ₂ O

- Blast furnaces give off many unpleasant and unhealthy gases. If the total air pressure is 0.990 atm, the partial pressure of carbon dioxide is 0.050 atm, and the partial pressure of hydrogen sulfide is 0.020 atm, what is the partial pressure of the remaining air?
- A sample of gas is collected over water at 25 °C. It has a pressure of 1.315 atm. What is the partial pressure of the gas collected in kPa? ($P_{\text{H}_2\text{O}}$ is 23.12 mmHg at 25 °C.)
- If a steel container holds 3.50 moles of hydrogen gas and 3.50 moles of helium gas, and the total pressure is 4.00 atm., what is the partial pressure of each of the gases?
- What's the partial pressure of carbon dioxide in a container that holds 5.00 moles of carbon dioxide, 3.00 moles of nitrogen, and 1.00 mole of hydrogen and has a total pressure of 1.05 atm?

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5. A 22.4 L glass bulb has a total pressure of 760. mmHg at 0.0°C and contains three different gases, nitrogen, helium and argon. If the partial pressure of nitrogen is 250. mmHg and the partial pressure of argon is 130. mmHg, what is the number of moles of helium in the tank? (*1 mol of gas at STP = 22.4L.*)
6. A cylinder contains 40. g of He, 56 g of N₂, and 40. g of Ar.
- How many moles of each gas are in the mixture?

 - If the total pressure of the mixture is 10. atm, what is the partial pressure of He?
7. A 15L scuba tank is filled with a gas mixture of 21.0% O₂, 35.0% He, and 44.0% N₂ (by mass) to a pressure of 4000.psi. What is the partial pressure of each gas?