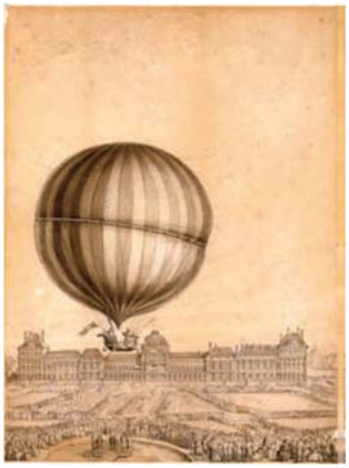
7.75 At a restaurant, a customer chokes on a piece of food. You put your arms around the person's waist and use your fists to push up on the person's abdomen, an action called the Heimlich maneuver.
   a. How would this action change the volume of the chest and lungs?
   b. Why does it cause the person to expel the food item from the airway?

7.76 An airplane is pressurized to 650. mmHg.
   a. If air is 21% oxygen, what is the partial pressure of oxygen on the plane?
   b. If the partial pressure of oxygen drops below 100. mmHg, passengers become drowsy. If this happens, oxygen masks are released. What is the total cabin pressure at which oxygen masks are dropped?

7.77 In 1783, Jacques Charles launched his first balloon filled with hydrogen gas, which he chose because it was lighter than air. The balloon had a volume of 31,000 L when it reached an altitude of 1000 m, where the pressure was 658 mmHg and the temperature was -8 ºC. How many kilograms of hydrogen were used to fill the balloon at STP?



7.78 Your spaceship has docked at a space station above Mars. The temperature inside the space station is a carefully controlled 24 ºC at a pressure of 745 mmHg. A balloon with a volume of 425 mL drifts into the airlock where the temperature is -95 ºC and the pressure is 0.115 atm. What is the new volume, in milliliters, of the balloon if n remains constant and the balloon is very elastic?

7.79 A fire extinguisher has a pressure of 10. atm at 25 ºC. What is the pressure, in atmospheres, if the fire extinguisher is used at a temperature of 75 ºC and V and n remain constant?

7.80 A weather balloon has a volume of 750 L when filled with helium at 8 ºC at a pressure of 380 torr. What is the new volume of the balloon when the pressure is 0.20 atm, the temperature is -45 ºC, and n remains constant?

7.81 A sample of hydrogen (H_2) gas at 127 ºC has a pressure of 2.00 atm. At what temperature (ºC) will the pressure of the H_2 decrease to 0.25 atm, if V and n remain constant?

7.82 A sample of nitrogen (N_2) gas has a pressure of 745 mmHg at 30. ºC. What is the pressure when the temperature rises to 125 ºC?

7.83 How many moles of CO_2 are in 35.0 L of $CO_{2(g)}$ at 1.2 atm and 5 ºC?

7.84 A container is filled with 0.67 mole of O_2 at 5 ºC and 845 mmHg. What is the volume, in milliliters, of the container?

7.85 A 2.00-L container is filled with methane gas (CH_4) at a pressure of 2500. mmHg and a temperature of 18 ºC. How many grams of methane are in the container?

7.86 A steel cylinder with a volume of 15.0 L is filled with 50.0 g of nitrogen gas at 25 ºC. What is the pressure, in atmospheres, of the N_2 gas in the cylinder?

7.87 When heated, calcium carbonate decomposes to give calcium oxide and carbon dioxide gas. If 56.0 g of $CaCO_3$ react, how many liters of CO_2 gas are produced at STP?

$$CaCO_{3(s)} \xrightarrow{\Delta} CaO_{(s)} + CO_{2(g)}$$

7.88 Magnesium reacts with oxygen to form magnesium oxide. How many liters of oxygen gas at STP are needed to react completely with 8.0 g of magnesium?

$$2Mg_{(s)} + O_{2(g)} \xrightarrow{\Delta} 2MgO_{(s)}$$

7.89 In the Haber process, H_2 and N_2 react to produce ammonia (NH_3). How many grams of N_2 are needed to produce 150 L of ammonia at STP?

$$3H_{2(g)} + N_{2(g)} \rightarrow 2NH_{3(g)}$$

7.90 How many liters of H_2 gas at STP can be produced from the reaction of 2.45 g of Al with excess HCl?

$$2Al_{(s)} + 6HCl_{(aq)} \rightarrow 2AlCl_{3(aq)} + 3H_{2(g)}$$

7.91 Aluminum oxide can be formed from its elements. What volume, in liters, of oxygen at STP is needed to completely react 5.4 g of Al?

$$4Al_{(s)} + 3O_{2(g)} \xrightarrow{\Delta} 2Al_2O_{3(s)}$$

7.92 Glucose, $C_6H_{12}O_6$, is metabolized in living systems to CO_2 and H_2O. How many grams of water can be produced from 12.5 L of O_2 at STP?

$$C_6H_{12}O_{6(s)} + 6O_{2(g)} \rightarrow 2CO_{2(g)} + 6H_2O_{(l)}$$

7.93 A sample of gas with a mass of 1.62 g has a volume of 941 mL at a pressure of 748 torr and a temperature of 20 ºC. What is the molar mass, g/mole, of the gas?

7.94 What is the molar mass, g/mole, of a gas if 1.15 g of the gas has a volume of 225 mL at STP?

7.95 Nitrogen dioxide reacts with water to produce oxygen and ammonia. How many liters of O_2 are produced when 0.42 mole of NO_2 reacts at STP?

$$4NO_{2(g)} + 6H_2O_{(g)} \xrightarrow{\Delta} 7O_{2(g)} + 4NH_{3(g)}$$

7.96 What is the volume, in liters, of H_2 gas produced at STP from the reaction of 25.0 g of Al?

$$2Al_{(s)} + 3H_2SO_{4(aq)} \rightarrow Al_2(SO_4)_{3(aq)} + 3H_{2(g)}$$

7.97 A weather balloon is partially filled with helium to allow for expansion at high altitudes. At STP, a weather balloon is filled with enough helium to give a volume of 25.0 L. How many grams of helium were added to the balloon?

7.98At an altitude of 30.0 km, where the temperature is -35 ºC, a weather balloon containing 1.75 moles of helium has a volume of 2,460 L. What is the pressure, in mmHg, of the helium inside the balloon?

7.99 A gas mixture contains oxygen and argon at partial pressures of 0.60 atm and 425 mm Hg. If nitrogen gas added to the sample increases the total pressure to 1,250 torr, what is the partial pressure, in torr, of the nitrogen added?

7.100 A gas mixture contains helium and oxygen at partial pressures of 255 torr and 0.450 atm. What is the total pressure, in mmHg, of the mixture after it is placed in a container one-half the volume of the original container?

Homework – Chapter 07 Chemistry 51
Los Angeles Mission College
Answers…

7.75 At a restaurant, a customer chokes on a piece of food. You put your arms around the person's waist and use your fists to push up on the person's abdomen, an action called the Heimlich maneuver.

a. How would this action change the volume of the chest and lungs?
The volume in the chest and lungs would decrease.

b. Why does it cause the person to expel the food item from the airway?
The decreased volume would result in an increase in pressure in the lungs. This increased pressure would result in air flowing out of the lungs to equalize the pressure. This outward flow of air would hopefully carry the piece of food out of the customer's throat.

7.76 An airplane is pressurized to 650. mmHg.

a. If air is 21% oxygen, what is the partial pressure of oxygen on the plane?

$$650.\ mm\ Hg\ x\ 21\%\ O_2 = \ 140\ mm\ Hg\ O_2$$

b. If the partial pressure of oxygen drops below 100. mmHg, passengers become drowsy. If this happens, oxygen masks are released. What is the total cabin pressure at which oxygen masks are dropped?

$$100.\ mm\ O_2 \Big/ _{21\%\ O_2} = 480\ mm\ Hg\ total\ cabin\ pressure$$

7.77 In 1783, Jacques Charles launched his first balloon filled with hydrogen gas, which he chose because it was lighter than air. The balloon had a volume of 31,000 L when it reached an altitude of 1000 m, where the pressure was 658 mmHg and the temperature was -8 ºC. How many kilograms of hydrogen were used to fill the balloon at STP?

$$PV = nRT$$

$$n = \frac{PV}{RT}$$

$$n = \frac{(658\ mm\ Hg)(31{,}000\ L)}{\left(0.0821 \frac{atm\ \cdot\ L}{mole\ \cdot\ K}\right)(273-8)K} * \frac{1\ atm}{760\ mm\ Hg} = 1{,}200\ moles$$

$$1{,}200\ moles\ H_2 * \frac{2.0\ g\ H_2}{1\ mole\ H_2} * \frac{1\ kg}{1{,}000\ g} = 2.4\ Kg\ H_2$$

7.78 Your spaceship has docked at a space station above Mars. The temperature inside the space station is a carefully controlled 24 ºC at a pressure of 745 mmHg. A balloon with a volume of 425 mL drifts into the airlock where the temperature is -95 ºC and the pressure is 0.115 atm. What is the new volume, in milliliters, of the balloon if n remains constant and the balloon is very elastic?

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{(745/760)atm \cdot (425\ ml)}{(273+24)K} = \frac{(0.115\ atm)\ \cdot V_2}{(273-95)K}$$

$$\frac{0.980\ atm}{0.115\ atm} * \frac{178\ K}{297\ K} * 425\ ml = \ V_2$$

$$V_2 = 2170\ ml$$

7.79 A fire extinguisher has a pressure of 10. atm at 25 ºC. What is the pressure, in atmospheres, if the fire extinguisher is used at a temperature of 75 ºC and V and n remain constant?

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$\frac{10\ atm}{(273+25)K} = \frac{P_2}{(273+75)K}$$

$$\frac{348\ K}{298\ K} * 10.\ atm = P_2$$

$$P_2 = 12\ atm$$

7.80 A weather balloon has a volume of 750 L when filled with helium at 8 ºC at a pressure of 380 torr. What is the new volume of the balloon when the pressure is 0.20 atm, the temperature is -45 ºC, and n remains constant?

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{(380\ torr)\ \cdot (750\ L)}{(273+8)K} = \frac{(0.20 * 760\ torr)V_2}{(273-45)K}$$

$$\frac{380\ torr}{150\ torr} * \frac{228\ K}{271\ K} * 750L\ = \ V_2$$

$$V_2 = 1{,}600L$$

7.81 A sample of hydrogen (H_2) gas at 127 ºC has a pressure of 2.00 atm. At what temperature (ºC) will the pressure of the H_2 decrease to 0.25 atm, if V and n remain constant?

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$
$$\frac{2.00\ atm}{(273+127)K} = \frac{0.25\ atm}{T_2}$$
$$\frac{0.25\ atm}{2.00\ atm} * 400\ K = T_2$$
$$T_2 = 50\ K = -220\ ℃$$

7.82 A sample of nitrogen (N_2) gas has a pressure of 745 mmHg at 30. ºC. What is the pressure when the temperature rises to 125 ºC?

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$
$$\frac{745\ mm\ Hg}{(273+30)K} = \frac{P_2}{(273+125)K}$$
$$\frac{398\ K}{303\ K} * 745\ mm\ Hg = P_2$$
$$P_2 = 979\ mm\ Hg$$

7.83 How many moles of CO_2 are in 35.0 L of $CO_{2(g)}$ at 1.2 atm and 5 ºC?

$$PV = nRT$$
$$n = \frac{PV}{RT}$$
$$n = \frac{(1.2\ atm)\cdot(35.0L)}{\left(0.0821\frac{atm\ \cdot\ L}{mole\ \cdot\ K}\right)\cdot(273+5)K}$$
$$n = 1.84\ moles$$

7.84 A container is filled with 0.67 mole of O_2 at 5 ºC and 845 mmHg. What is the volume, in milliliters, of the container?

$$PV = nRT$$
$$V = \frac{nRT}{P}$$
$$V = \frac{(0.67\ mole)\cdot\left(0.0821\frac{atm\ \cdot\ L}{mole\ \cdot\ K}\right)\cdot(273+5)K}{\left({}^{845\ mm\ Hg}/_{760\ mm\ Hg/atm}\right)}$$
$$V = 14\ L$$
$$V = 14{,}000\ mL$$

7.85 A 2.00-L container is filled with methane gas (CH_4) at a pressure of 2500. mmHg and a temperature of 18 ºC. How many grams of methane are in the container?

$$PV = nRT$$
$$n = \frac{PV}{RT}$$
$$n = \frac{(2500\ mm\ Hg)(2.00\ L)}{\left(0.0821\frac{atm\ \cdot\ L}{mole\ \cdot\ K}\right)(273+18)K} * \frac{1\ atm}{760\ mm\ Hg} = 0.275\ moles$$
$$0.275\ moles\ CH_4 * \frac{16.0\ g\ CH_4}{1\ mole\ CH_4} * \frac{1\ kg}{1{,}000\ g} = 4.4\ g\ CH_4$$

7.86 A steel cylinder with a volume of 15.0 L is filled with 50.0 g of nitrogen gas at 25 ºC. What is the pressure, in atmospheres, of the N_2 gas in the cylinder?

$$PV = nRT$$
$$P = \frac{nRT}{V}$$
$$n = 50.0\ gN_2 * \frac{1\ mole\ N_2}{28.0\ g\ N_2} = 1.79\ moles$$
$$P = \frac{(1.79\ moles)\cdot\left(0.0821\frac{atm\ \cdot\ L}{mole\ \cdot\ K}\right)\cdot(273+25)K}{15.0\ L}$$
$$P = 2.91\ atm$$

7.87 When heated, calcium carbonate decomposes to give calcium oxide and carbon dioxide gas. If 56.0 g of $CaCO_3$ react, how many liters of CO_2 gas are produced at STP?

$$CaCO_{3(s)} \xrightarrow{\Delta} CaO_{(s)} + CO_{2(g)}$$

$$n = 56.0\ g CaCO_3 * \frac{1\ mole\ CaCO_3}{100\ g\ CaCO_3} = 0.560\ moles\ CaCO_3$$

$$moles\ CaCO_3 = moles\ CO_2 = 0.560\ moles$$

$$0.560\ moles\ CO_2 * \frac{22.4\ L}{1\ mole} = 12.5\ L\ CO_2$$

7.88 Magnesium reacts with oxygen to form magnesium oxide. How many liters of oxygen gas at STP are needed to react completely with 8.0 g of magnesium?

$$2Mg_{(s)} + O_{2(g)} \xrightarrow{\Delta} 2MgO_{(s)}$$

$$n = 8.0\ g\ Mg * \frac{1\ mole\ Mg}{24.3\ g\ Mg} = 0.33\ moles\ Mg$$

$$2\ moles\ Mg = 1\ moles\ O_2 = 0.16\ moles\ O_2$$

$$0.16\ moles\ O_2 * \frac{22.4\ L}{1\ mole} = 3.8\ L\ O_2$$

7.89 In the Haber process, H_2 and N_2 react to produce ammonia (NH_3). How many grams of N_2 are needed to produce 150 L of ammonia at STP?

$$3H_{2(g)} + N_{2(g)} \rightarrow 2NH_{3(g)}$$

$$150\ L\ NH_3 * \frac{1\ mole}{22.4\ Liters} = 6.7\ moles\ NH_3$$

$$6.7\ moles\ NH_3 * \frac{1\ moles\ N_2}{2\ moles\ NH_3} = 3.3\ moles\ N_2$$

$$3.3\ moles\ N_2 * \frac{28.0\ grams\ N_2}{1\ mole\ N_2} = 94\ grams\ N_2$$

7.90 How many liters of H_2 gas at STP can be produced from the reaction of 2.45 g of Al with excess HCl?

$$2Al_{(s)} + 6HCl_{(aq)} \rightarrow 2AlCl_{3(aq)} + 3H_{2(g)}$$

$$2.45\ g\ Al * \frac{1\ mole\ Al}{27.0\ g\ Al} = 0.0907\ moles\ Al$$

$$0.0907\ moles\ Al * \frac{3\ moles\ H_2}{2\ moles\ Al} = 0.136\ moles\ H_2$$

$$0.136\ moles\ H_2 * \frac{22.4\ Liters}{1\ mole} = 3.05\ L\ H_2$$

7.91 Aluminum oxide can be formed from its elements. What volume, in liters, of oxygen at STP is needed to completely react 5.4 g of Al?

$$4Al_{(s)} + 3O_{2(g)} \xrightarrow{\Delta} 2Al_2O_{3(s)}$$

$$5.4\ g\ Al * \frac{1\ mole\ Al}{27.0\ g\ Al} * \frac{3\ moles\ O_2}{4\ moles\ Al} * \frac{22.4\ L\ O_2}{1\ mole\ O_2} = 3.4\ L\ O_2$$

7.92 Glucose, $C_6H_{12}O_6$, is metabolized in living systems to CO_2 and H_2O. How many grams of water can be produced from 12.5 L of O_2 at STP?

$$C_6H_{12}O_{6(s)} + 6O_{2(g)} \rightarrow 2CO_{2(g)} + 6H_2O_{(l)}$$

$$12.5\ L\ O_2 * \frac{1\ mole\ O_2}{22.4\ L\ O_2} * \frac{6\ moles\ H_2O}{6\ moles\ O_2} * \frac{18.0\ g\ H_2O}{1\ mole\ H_2O} = 10.0\ g$$

7.93 A sample of gas with a mass of 1.62 g has a volume of 941 mL at a pressure of 748 torr and a temperature of 20 °C. What is the molar mass, g/mole, of the gas?

$$PV = nRT$$

$$n = \frac{PV}{RT}$$

$$n = \frac{(748\ torr)(0.941L)}{\left(0.0821 \frac{atm \cdot L}{mole \cdot K}\right)(273 + 20)K} * \frac{1\ atm}{760\ torr} = 0.0385\ moles$$

$$Molar\ Mass = \frac{Grams}{Mole} = \frac{1.62\ grams}{0.0385\ moles} = 42.1\ {}^{grams}/_{mole}$$

7.94 What is the molar mass, g/mole, of a gas if 1.15 g of the gas has a volume of 225 mL at STP?

$$0.225\ L * \frac{1\ mole}{22.4\ L} = 0.0100\ moles$$

$$Molar\ Mass = \frac{Grams}{Mole} = \frac{1.15\ grams}{0.0100\ moles} = 114\ {}^{grams}/_{mole}$$

7.95 Nitrogen dioxide reacts with water to produce oxygen and ammonia. How many liters of O_2 are produced when 0.42 mole of NO_2 reacts at STP?

$$4NO_{2(g)} + 6H_2O_{(g)} \xrightarrow{\Delta} 7O_{2(g)} + 4NH_{3(g)}$$

$$0.42\ mole\ NO_2 * \frac{7\ moles\ O_2}{4\ moles\ NO_2} * \frac{22.4\ L\ O_2}{mole\ O_2} = 16\ L\ O_2$$

7.96 What is the volume, in liters, of H_2 gas produced at STP from the reaction of 25.0 g of Al?

$$2Al_{(s)} + 3H_2SO_{4(aq)} \rightarrow Al_2(SO_4)_{3(aq)} + 3H_{2(g)}$$

$$25.0\ g\ Al * \frac{1\ mole\ Al}{27.0\ grams\ Al} * \frac{3\ moles\ H_2}{2\ moles\ Al} * \frac{22.4\ L\ H_2}{1\ mole\ H_2} = 31.1\ L\ H_2$$

7.97 A weather balloon is partially filled with helium to allow for expansion at high altitudes. At STP, a weather balloon is filled with enough helium to give a volume of 25.0 L. How many grams of helium were added to the balloon?

$$25.0\ L\ He * \frac{1\ mole\ He}{22.4\ L\ He} * \frac{4.00\ g\ He}{1\ mole\ He} = 4.46\ g\ He$$

7.98 At an altitude of 30.0 km, where the temperature is -35 ºC, a weather balloon containing 1.75 moles of helium has a volume of 2,460 L. What is the pressure, in mmHg, of the helium inside the balloon?

$$PV = nRT$$

$$P = \frac{nRT}{V}$$

$$P = \frac{(1.75\ moles) \cdot \left(0.0821 \frac{atm\ \cdot\ L}{mole\ \cdot\ K}\right) \cdot (273 - 35)K}{2{,}460\ L} = 0.0139\ atm$$

$$0.0139\ atm * \frac{760\ mm\ Hg}{1\ atm} = 10.6\ mm\ Hg$$

7.99 A gas mixture contains oxygen and argon at partial pressures of 0.60 atm and 425 mm Hg. If nitrogen gas added to the sample increases the total pressure to 1,250 torr, what is the partial pressure, in torr, of the nitrogen added?

$$Partial\ Pressure\ due\ to\ O_2 = 0.60\ atm * \frac{760\ torr}{1\ atm} = 460\ torr$$

$$Partial\ Pressure\ due\ to\ Ar = 425\ mm\ Hg * \frac{1\ torr}{1\ mm\ Hg} = 425\ torr$$

$$Partial\ Pressure\ due\ to\ N_2 = (1{,}250 - 460 - 425)\ torr = 360\ torr$$

7.100 A gas mixture contains helium and oxygen at partial pressures of 255 torr and 0.450 atm. What is the total pressure, in mmHg, of the mixture after it is placed in a container one-half the volume of the original container?

$$Partial\ Pressure\ due\ to\ He = 255\ torr * \frac{1\ mm\ Hg}{1\ torr} = 255\ mm\ Hg$$

$$Partial\ Pressure\ due\ to\ O_2 = 0.450\ atm * \frac{760\ mm\ Hg}{1\ atm} = 342\ mm\ Hg$$

$$Total\ Pressure\ (original\ container) = (255 + 342) mm\ Hg = 597\ mm\ Hg$$

$$P_1V_1 = P_2V_2$$

$$If\ the\ volume\ is\ cut\ in\ half, then\ the\ pressure\ will\ be\ doubled$$

$$Total\ Pressure\ (half\ container) = 2 * 597\ mm\ Hg = 1190\ mm\ Hg$$