EVERETT COMMUNITY COLLEGE

TRiO STUDENT SUPPORT SERVICES

MIXED GAS LAWS WORKSHEET

1) How many moles of gas occupy 98 L at a pressure of 2.8 atmospheres and a temperature of 292 K?

2) If 5.0 moles of O_2 and 3.0 moles of N_2 are placed in a 30.0 L tank at a temperature of 25^0 C, what will the pressure of the resulting mixture of gases be?

3) A balloon is filled with 35.0 L of helium in the morning when the temperature is 20.0^0 C. By noon the temperature has risen to 45.0^0 C. What is the new volume of the balloon?

4) A 35 L tank of oxygen is at 315 K with an internal pressure of 190 atmospheres. How many moles of gas does the tank contain?

5) A balloon that can hold 85 L of air is inflated with 3.5 moles of gas at a pressure of 1.0 atmosphere. What is the temperature in ^{0}C of the balloon?

6) $CaCO_3$ decomposes at 1200^0 C to form CO_2 gas and CaO. If 25 L of CO_2 are collected at 1200^0 C, what will the volume of this gas be after it cools to 25^0 C?

7) A helium balloon with an internal pressure of 1.00 atm and a volume of 4.50 L at 20.0^0 C is released. What volume will the balloon occupy at an altitude where the pressure is 0.600 atm and the temperature is –20.0^0 C?

8) There are 135 L of gas in a container at a temperature of 260^0 C. If the gas was cooled until the volume decreased to 75 L, what would the temperature of the gas be?

9) A 75 L container holds 62 moles of gas at a temperature of 215^0 C. What is the pressure in atmospheres inside the container?

10) 6.0 L of gas in a piston at a pressure of 1.0 atm are compressed until the volume is 3.5 L. What is the new pressure inside the piston?

11) A gas canister can tolerate internal pressures up to 210 atmospheres. If a 2.0 L canister holding 3.5 moles of gas is heated to 1350^0 C, will the canister explode?

12) The initial volume of a gas at a pressure of 3.2 atm is 2.9 L. What will the volume be if the pressure is increased to 4.0 atm?

13) An airtight container with a volume of 4.25×10^4 L, an internal pressure of 1.00 atm, and an internal temperature of 15.0^0 C is washed off the deck of a ship and sinks to a depth where the pressure is 175 atm and the temperature is 3.00^0 C. What will the volume of the gas inside be when the container breaks under the pressure at this depth?

14) Two flasks are connected with a stopcock. Flask #1 has a volume of 2.5 L and contains oxygen gas at a pressure of 0.70 atm. Flask #2 has a volume of 3.8 L and contains hydrogen gas at a pressure of 1.25 atm. When the stopcock between the two flasks is opened and the gases are allowed to mix, what will the resulting pressure of the gas mixture be?

15) A weather balloon has a volume of 35 L at sea level (1.0 atm). After the balloon is released it rises to where the air pressure is 0.75 atm. What will the new volume of the weather balloon be?

MIXED GAS LAWS WORKSHEET - SOLUTIONS

1) How many moles of gas occupy 98 L at a pressure of 2.8 atmospheres and a temperature of 292 K?

$$n = \frac{PV}{RT} = \frac{(2.8\ \text{atm})(98\ \text{L})}{(0.0821\ \text{L}\cdot\text{atm/mol}\cdot\text{K})(292\ \text{K})} = 11\ \text{moles of gas}$$

2) If 5.0 moles of O_2 and 3.0 moles of N_2 are placed in a 30.0 L tank at a temperature of 25^0 C, what will the pressure of the resulting mixture of gases be? **25^0 C = 298 K**

$$O_2\text{: } P = \frac{nRT}{V} = \frac{(5.0\ \text{mol})(0.0821\ \text{L}\cdot\text{atm/mol}\cdot\text{K})(298\ \text{K})}{(30.0\ \text{L})} = 4.1\ \text{atm}$$

$$N_2\text{: } P = \frac{nRT}{V} = \frac{(3.0\ \text{mol})(0.0821\ \text{L}\cdot\text{atm/mol}\cdot\text{K})(298\ \text{K})}{(30.0\ \text{L})} = 2.4\ \text{atm}$$

$$P_{Tot} = P_{O2} + P_{N2} = 4.1\ \text{atm} + 2.4\ \text{atm} = 6.5\ \text{atm}$$

3) A balloon is filled with 35.0 L of helium in the morning when the temperature is 20.0^0 C. By noon the temperature has risen to 45.0^0 C. What is the new volume of the balloon?

$T_1 = 20.0^0$ C = 293 K, V_1 = 35.0 L, $T_2 = 45.0^0$ C = 318 K, V_2 = ?

$$V_2 = \frac{V_1 T_2}{T_1} = \frac{(35.0\ \text{L})(318\ \text{K})}{(293\ \text{K})} = 38.0\ \text{L}$$

4) A 35 L tank of oxygen is at 315 K with an internal pressure of 190 atmospheres. How many moles of gas does the tank contain?

$$n = \frac{PV}{RT} = \frac{(190\ \text{atm})(35\ \text{L})}{(0.0821\ \text{L}\cdot\text{atm/mol}\cdot\text{K})(315\ \text{K})} = 260\ \text{moles of gas}$$

5) A balloon that can hold 85 L of air is inflated with 3.5 moles of gas at a pressure of 1.0 atmosphere. What is the temperature in ^{0}C of the balloon?

$$T = \frac{PV}{nR} = \frac{(1\ \text{atm})(85\ \text{L})}{(3.5\ \text{mol})(0.0821\ \text{L}\cdot\text{atm/mol}\cdot\text{K})} = 296\ \text{K} = 23^0\ \text{C}$$

6) $CaCO_3$ decomposes at 1200^0 C to form CO_2 gas and CaO. If 25 L of CO_2 are collected at 1200^0 C, what will the volume of this gas be after it cools to 25^0 C?

$T_1 = 1200^0$ C = 1473 K, V_1 = 25 L, $T_2 = 25^0$ C = 298 K, V_2 = ?

$$V_2 = \frac{V_1 T_2}{T_1} = \frac{(25\ \text{L})(298\ \text{K})}{(1473\ \text{K})} = 5.1\ \text{L}$$

7) A helium balloon with an internal pressure of 1.00 atm and a volume of 4.50 L at 20.0^0 C is released. What volume will the balloon occupy at an altitude where the pressure is 0.600 atm and the temperature is -20.0^0 C?

P_1 = 1.00 atm, V_1 = 4.50 L, $T_1 = 20.0^0$ C = 293 K, P_2 = 0.600 atm, V_2 = ?,
$T_2 = -20.0^0$ C = 253 K

$$V_2 = \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{(1.00\ \text{atm})(4.50\ \text{L})(253\ \text{K})}{(293\ \text{K})(0.600\ \text{atm})} = 6.48\ \text{L}$$

8) There are 135 L of gas in a container at a temperature of 260^0 C. If the gas was cooled until the volume decreased to 75 L, what would the temperature of the gas be?

$T_1 = 260^0$ C = 533 K, V_1 = 135 L, T_2 = ?, V_2 = 75 L

$$T_2 = \frac{V_2 T_1}{V_1} = \frac{(75\ \text{L})(533\ \text{K})}{(135\ \text{L})} = 296\ \text{K} = 23^0\ \text{C}$$

9) A 75 L container holds 62 moles of gas at a temperature of 215^0 C. What is the pressure in atmospheres inside the container? **215^0 C = 488 K**

$$P = \frac{nRT}{V} = \frac{(62\ mol)(0.0821\ L \cdot atm/mol \cdot K)(488\ K)}{(75\ L)} = 33\ atm$$

10) 6.0 L of gas in a piston at a pressure of 1.0 atm are compressed until the volume is 3.5 L. What is the new pressure inside the piston?

P_1 = 1.0 atm, V_1 = 6.0 L, P_2 = ?, V_2 = 3.5 L

$$P_2 = \frac{P_1 V_1}{V_2} = \frac{(1.0\ atm)(6.0\ L)}{(3.5\ L)} = 1.7\ atm$$

11) A gas canister can tolerate internal pressures up to 210 atmospheres. If a 2.0 L canister holding 3.5 moles of gas is heated to 1350^0 C, will the canister explode? **1350^0 C = 1623 K**

$$P = \frac{nRT}{V} = \frac{(3.5\ mol)(0.0821\ L \cdot atm/mol \cdot K)(1623\ K)}{(2.0\ L)} = 230\ atm$$

Yes, the canister will explode.

12) The initial volume of a gas at a pressure of 3.2 atm is 2.9 L. What will the volume be if the pressure is increased to 4.0 atm?

P_1 = 3.2 atm, V_1 = 2.9 L, P_2 = 4.0 atm, V_2 = ?

$$V_2 = \frac{P_1 V_1}{P_2} = \frac{(3.2\ atm)(2.9\ L)}{(4.0\ atm)} = 2.3\ L$$

13) An airtight container with a volume of 4.25 x 10^4 L, an internal pressure of 1.00 atm, and an internal temperature of 15.0^0 C is washed off the deck of a ship and sinks to a depth where the pressure is 175 atm and the temperature is 3.00^0 C. What will the volume of the gas inside be when the container breaks under the pressure at this depth?

P_1 = 1.00 atm, V_1 = 4.25 x 10^4 L, T_1 = 15.0^0 C = 288 K, P_2 = 175 atm, V_2 = ?, T_2 = 3.00^0 C = 276 K

$$V_2 = \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{(1.00\ atm)(4.25 \times 10^4\ L)(276\ K)}{(288\ K)(175\ atm)} = 233\ L$$

14) Two flasks are connected with a stopcock. Flask #1 has a volume of 2.5 L and contains oxygen gas at a pressure of 0.70 atm. Flask #2 has a volume of 3.8 L and contains hydrogen gas at a pressure of 1.25 atm. When the stopcock between the two flasks is opened and the gases are allowed to mix, what will the resulting pressure of the gas mixture be? (**P' & V' are initial conditions before mixing)**

P'_{O2} = 0.70 atm, P'_{H2} = 1.25 atm, V'_{O2} = 2.5 L, V'_{H2} = 3.8 L, V = 6.3 L

O_2: $$P_2 = \frac{P'_{O2} V'_{O2}}{V} = \frac{(0.70\ atm)(2.5\ L)}{(6.3\ L)} = 0.28\ atm$$

H_2: $$P_2 = \frac{P'_{H2} V'_{H2}}{V} = \frac{(1.25\ atm)(3.8\ L)}{(6.3\ L)} = 0.75\ atm$$

$$P_{Tot} = P_{O2} + P_{H2} = 0.28\ atm + 0.75\ atm = 1.0\ atm$$

15) A weather balloon has a volume of 35 L at sea level (1.0 atm). After the balloon is released it rises to where the air pressure is 0.75 atm. What will the new volume of the weather balloon be?

P_1 = 1.0 atm, V_1 = 35 L, P_2 = 0.75 atm, V_2 = ?

$$V_2 = \frac{P_1 V_1}{P_2} = \frac{(1.0\ atm)(35\ L)}{(0.75\ atm)} = 47\ L$$