Gases

1) If I have 5.6 liters of gas in a piston at a pressure of 1.5 atm and compress the gas until its volume is 2.3 L, what will the new pressure inside the piston be?

$(1.5atm)(5.6L) = (2.3L)(P_2)$
$P_2 = 3.7$ atm

2) I have added 18.2 L of air to a balloon at sea level (1.0 atm). If I take the balloon with me to Denver, where the air pressure is 0.85 atm, what will the new volume of the balloon be?

$(1atm)(18.2L) = (0.85atm)(V_2)$
$V_2 = 21.4$ L

3) I've got a car with an internal volume of 12,000 L. If I drive my car into the river and it implodes, what will be the volume of the gas when the pressure goes from 1.0 atm to 2.4 atm?

$(1atm)(12000L) = (2.4atm)(V_2)$
$V_2 = 5000$ L

4) If I have 29.3 liters of helium in a balloon at 25°C and increase the temperature of the balloon to 55°C, what will the new volume of theballoon be? 5) Calcium carbonate decomposes at 1200°C to form carbon dioxide and calcium oxide. If 82 liters of carbon dioxide are collected at 1200°C, what will the volume of this gas be after it cools to 25°C?

$(29.3L)(328K) = (298K)(V_2)$
$V_2 = 32.2$ L

5) I have 130 liters of gas in a piston at a temperature of 250°C. If I cool the gas until the volume decreases to 49.5 liters, what will temperature of the gas be?

$(130L)/(273K + 250) = (49.5\ L)/\ (T_2)$
$T_2 = 199\ K = -74\ K$

6) A commercial airliner has an internal pressure of 1.00 atm and temperature of 25°C at takeoff. If the temperature of the airliner drops to 10°C during the flight, what is the new cabin pressure?

$(1atm)/(273K + 25) = (P_2)/(273K + 10)$
$P_2 = .95$ atm

7) If divers rise too quickly from a deep dive, they get a condition called "the bends" which is caused by the expansion of very small nitrogen bubbles in the blood due to decreased pressure. If the initial volume of the bubbles in a diver's blood is 18.2 mL and the initial pressure is 12.75 atm, what is the volume of the bubbles when the diver has surfaced to atm pressure?

$(12.75\ atm)/(18.2\ mL) = (1\ atm)/(V_2)$
$V_2 = 232.05$ mL

Combined gas law

1) A child has a toy balloon with a volume of 1.80 liters. The temperature of the balloon when it was filled was 20°C and the pressure was 1.00 atm. If the child were to let go of the balloon and it rose 3 kilometers into the sky where the pressure is 0.667 atm and the temperature is 10°C, what would the new volume of the balloon be?

$$\frac{(1.8L)(1atm)}{293K} = \frac{(0.667atm)(V_2)}{263K}$$

$V_2 = 2.42\ L$

Ideal gas law

2) How many moles of gas does it take to occupy 120 liters at a pressure of 3.2 atmospheres and a temperature of 340 K?

$(3.2atm)(120L) =$

$n(0.08206)(340K)$

$n = 13.76\ moles$

3) If I have a 62.5 liter container that holds 45 moles of gas at a temperature of 200°C, what is the pressure inside the container?

$(P)(62.5L) =$

$(45)(0.08206)(473K)$

$P = 27.94\ atm$

4) It is not safe to put aerosol canisters in a campfire, because the pressure inside the canisters gets very high and they can explode. If I have a 1.89 liter canister that holds 2 moles of gas, and the campfire temperature is 1400°C, what is the pressure inside the canister?

$(P)(1.89L) =$

$(2)(0.08206)(1673K)$

$P = 145.28\ atm$

5) How many moles of gas are in a 25 liter scuba canister if the temperature of the canister is 300 K and the pressure is 200 atmospheres?

5) $(200atm)(25L) =$

$n(0.08206)(300K)$

$n = 203.1\ moles$

6) I have a balloon that can hold 100 liters of air. If I blow up this balloon with 3 moles of oxygen gas at a pressure of 1 atmosphere, what is the temperature of the balloon?

Dalton's Law of Partial Pressures Worksheet

$(1atm)(100L) = (3)(0.08206)(T)$

$T = 406.2\ K$

7) If I place 2 moles of N2 and 9 moles of O_2 in a 35 L container at a temperature of 25°C, what will the pressure of the resulting mixture of gases be?

$(P)(35L) = (2)(0.08206)(298K)$

$P_{N2} = 1.39$

$(P)(35L) = (9)(0.08206)(298K)$

$P_{O2} = 6.29$

$P_{N2} + P_{O2} = 7.68\ atm$

8) Two balloons are connected with a sealable valve. The first balloon has a volume of 5 liters and contains nitrogen gas at a pressure of 0.75 atm. The second balloon has a volume of 8 L and contains oxygen gas at a pressure of 1.25 atm. When the valve between the balloons is opened and the gases are free to mix, what will the pressure be in the resulting mixture?

$(0.75atm)(5L) = (P_2)(13L)$

$P_{N2} = 0.288atm$

$(1.25atm)(8L) = (P_2)(13L)$

$P_{O2} = 0.769atm$

$P_{N2} + P_{O2} = 1.057\ atm$