Temperature
K = ºC + 273

Kelvin to Degrees C	Degrees C to Kelvin
373K	56ºC
128K	154ºC
800K	-10ºC

Pressure
760mmHg = 101.3 kPa = 1 atm

mm Hg into kPa and atm	kPa into atm and mmHg	Atm into kPa and mmHg
890 mm Hg	123 kPa	0.64 atm
3140 mm Hg	25 kPa	2.35 atm

Boyle's Law

1. 1.00 L of a gas at standard temp and pressure is compressed to 473 mL. What is the new pressure of the gas?

2. In a thermonuclear device (a bomb), the gas inside of the bomb only takes up a space of .050 L, but it reaches a pressure of 4.0×10^6 atm right before it explodes. When it explodes, this gas is now under 1.00 atm of pressure. How much space will it take up now?

3. If I took 2.00 liters of gas at 1.00 atm and compressed it to a pressure of 6.00×10^4 atm, what would the volume of that gas be?

4. Atmospheric pressure on the peak of Mt. Everest can be as low as 150 mm Hg, which is why climbers need to bring oxygen tanks for the last part of the climb. If the climbers carry a 10.0 liter tanks with an internal gas pressure of 3.04×10^4 mm Hg, what will be the volume of the gas when it is released from the tanks?

5. Submarines need to be extremely strong to withstand the extremely high pressure of water pushing down on them. A small submarine has a volume of 15,000 liters (about the size of a small school bus) has an internal pressure of 1.2 atm. If the pressure of the ocean breaks the submarine, the bubble of air that was in the submarine will now have 250 atm pushing on it, how big will that bubble of air now be?

6. Divers get "the bends" if they come up too fast because gas in their blood expands, forming bubbles in their blood. If a diver has 0.05 L of gas in his blood under a pressure of 250 atm, then rises instantaneously to a depth where his blood has a pressure of 50.0 atm, what will the volume of gas in his blood be? Do you think this will harm the diver?

Charles's Law

1. The temp inside my refrigerator is about 4.0 degrees Celsius. If I place a balloon in my fridge that initially had a temperature of 22 degrees C and a volume of 0.50 liters, what will be the volume of the balloon when it is fully cooled by my refrigerator?

2. A man heats a balloon in the oven. If the balloon initially has a volume of 0.40 liters and a temperature of 20.0 degrees Celsius, what will the volume of the balloon be after he heats it to a temperature of 250 degrees C?

3. On hot days you may have noticed that potato chip bags seem to "inflate", even those they have not been opened. If I have a 250.0 mL bag at a temperature of 19.0 degrees C and I leave it in my car which as a temperature of 60.0 degrees C, what will the new volume of the bag be?

4. A soda bottle is flexible enough that the volume of the bottle can change even without opening it. If you have an empty soda bottle (volume of 2.0 L) at 20 degrees celsius, what will the new volume be if you put it in your freezer at -4.0 degrees C?

5. Some students believe that teachers are full of hot air. If I inhale 2.2 liters of gas at a temperature of 18 degrees C and it heats up to a temperature of 38 degrees C in my lungs, what would the new volume of the gas be?

6. How hot will a 2.3 L balloon have to get to expand to a volume of 400. L? Assume the initial temperature of the balloon is 25 degrees C.

Combined Gas Law Practice Sheet

1. A bag of potato chips is packaged at sea level (1.00 atm) and has a volume of 315 mL. If this bag of chips is transported to Denver (0.775 atm), what will the new volume of the bag be?

2. A Los Angeles class nuclear submarine has an internal volume of eleven million liters at a pressure of 1.250 atm. If a crewman were to open one of the hatches to the outside ocean while it was underwater (pressure = 15.75 atm), what would be the new volume of the air inside the submarine?

3. A child has a toy balloon with a volume of 1.80 liters. The temperature of the balloon when it was filled was 20^{o} 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^{o} C, what would the new volume of the balloon be?

4. A commercial airliner has an internal pressure of 1.00 atm and temperature of 25^{o} C at takeoff. If the temperature of the airliner drops to 17^{o} C during the flight, what is the new cabin pressure?

5. 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 15 mL and the initial pressure is 12.75 atm, what is the volume of the bubbles when the diver has surfaced to 1.00 atm pressure?

Ideal Gas Law Problems

1. If I have 4.0 moles of a gas at a pressure of 5.6 atm and a volume of 12 liters, what is the temperature?

2. If I have an unknown quantity of gas at a pressure of 1.2 atm, a volume of 31 liters, and a temperature of 87 ^{o}C, how many moles of gas do I have?

3. If I contain 3.0 moles of gas in a container with a volume of 60. liters and at a temperature of 400. K, what is the pressure inside the container?

4. If I have 7.7 moles of gas at a pressure of 0.090 atm and at a temperature of 56 ^{o}C, what is the volume of the container that the gas is in?

5. If I have 17 moles of gas at a temperature of 67 ^{o}C, and a volume of 88.89 liters, what is the pressure of the gas?

6. If I have an unknown quantity of gas at a pressure of 0.50 atm, a volume of 25 liters, and a temperature of 300. K, how many moles of gas do I have?

The Ideal and Combined Gas Laws

1. If four moles of a gas at a pressure of 5.4 atmospheres have a volume of 120 liters, what is the temperature?

2. If I initially have a gas with a pressure of 84 kPa and a temperature of 350 C and I heat it an additional 230 degrees, what will the new pressure be? Assume the volume of the container is constant.

3. My car has an internal volume of 2600 liters. If the sun heats my car from a temperature of 200 C to a temperature of 550 C, what will the pressure inside my car be? Assume the pressure was initially 760 mm Hg.

4. How many moles of gas are in my car in problem #3?

5. A toy balloon filled with air has an internal pressure of 1.25 atm and a volume of 2.50 L. If I take the balloon to the bottom of the ocean where the pressure is 95 atmospheres, what will the new volume of the balloon be? How many moles of gas does the balloon hold if the temperature is 285 K?

6. How many grams of oxygen gas do you have if it takes up 3.2 L of space while at a a temperature of 45 degrees C and a pressure of 1.25 atm?

Chemistry: *Dalton's Law of Partial Pressure*

1. Container A (with volume 1.23 L) contains a gas under 3.24 atm of pressure. Container B (with volume 0.93 L) contains a gas under 2.82 atm of pressure. Container C (with volume 1.42 L) contains a gas under 1.21 atm of pressure. If all of these gases are put into Container D (with volume 1.51 L), what is the pressure in Container D?

2. Container A (with volume 1.56 L) contains a gas under 185.3 kPa of pressure. Container B has $^1/_3$ the volume of Container A, but its gas is under twice the pressure as that of Container A. If the gases from A and B are combined into Container C (with volume 0.95 L), what is the pressure in Container C?

3. Container A (with volume 150 mL) contains a gas under an unknown pressure. Container B (with volume 250 mL) contains a gas under 628 mm Hg of pressure. Container C (with volume 350 mL) contains a gas under 437 mm Hg of pressure. If all of these gases are put into Container D (with volume 300 mL),, giving it 1439 mm Hg of pressure, find the original pressure of the gas in Container A.

4. The gases of three identical containers A, B, and C are under pressures of 1.44 atm, 3.16 atm, and 2.52 atm, respectively. These gases are then combined into Container D (with a volume of 3.92 L) so that the pressure in Container D is 4.38 atm. Containers A, B, and C have the same volume. Find that volume.

Gas Stoichiometry Practice Sheet ***Are you at STP? If it isn't stated, assume it is at STP.***

1. For the balanced reaction $2\ H_{2(g)} + O_{2(g)} \rightarrow 2\ H_2O_{(g)}$, how many liters of water can be made from 5 L of oxygen gas and an excess of hydrogen?

2. How many liters of water can be made from 55 grams of oxygen gas and an excess of hydrogen at STP? (using the balanced reaction from #1)

3. How many liters of water can be made from 55 grams of oxygen gas and an excess of hydrogen at a pressure of 12.4 atm and a temperature of 85^{o} C? (using the balanced reaction from #1)

4. How many liters of water can be made from 34 grams of oxygen gas and 6.0 grams of hydrogen gas at STP? What is the limiting reactant for this reaction?

5. What volume of C_8H_{18} is required to fill a 1.4 L airbag with CO_2 if the vehicle burns octane at STP, to produce the CO2 used in the airbag? Yes, this one is tough to balance.

____C_8H_{18} + ____O_2 → ____CO_2 + ____H_2O

6. A scuba diver dives with a tank containing 5L of air. Twenty-two percent of the air is oxygen. If the diver produces 1.62 mol carbon dioxide for every 2.05 mol of oxygen he/she inhales, what is the volume of carbon dioxide produced if 4.2 L of air are consumed at STP?

2.05 mol O2 → 1.62 mol CO2

7. If 34.6g of Zn are reacted with an excess of hydrochloric acid at standard pressure, what is the temperature of the hydrogen gas produced if it occupies a 2.00 L container?

_____Zn + _____HCl → _____ZnCl + _____H_2

Temp
100 C 329K
-145C 427K
527C 263K

Pressure
120 kPa /1.2atm 923 mmHg /1.21atm 490mmHg / 65kPa
419 kPa / 4.13atm .25 atm / 190 mmHg 238 kPa / 1790 mmHg

Boyle's	2.11atm	2.0×10^{5} L	3.33×10^{-5} L	2.0×10^{3} L	72 L	.3L yes
Charles's	.47L	.71 L	285mL	2L	2.4L	52,000K
Combined	406 mL	8.730×10^{5}L	2L	.97 atm	190mL	
Ideal	2.0×10^{2} K	1.3mol	1.6atm	2300L	5.3 atm	.51 mol
Ideal/combine	2.0×10^{3} K	1.1atm	2atm	70 moles	.033 L and .134 moles	4.9grams
Dalton	5.51atm	510 kPa	800 mmHg	2.41L		
Gas Stoich	10L	77L	8L	Oxygen 48L of H2O	.18L	.73L 91.6K