Boyle's Law	Charles' Law	Guy-Lassac's Law	Combined Gas Law
For a given mass of gas at constant temperature, the volume of a gas varies inversely with pressure	The volume of a fixed mass of gas is directly proportional to its Kelvin temperature if the pressure is kept constant.	The pressure of a gas is directly proportional to the Kelvin temperature if the volume is kept constant.	Combines Boyle's, Charles', and the Temperature-Pressure relationship into one equation. Each of these laws can be derived from this law.
$PV = k$ $P_1V_1 = P_2V_2$	$\frac{V}{T} = k$ $V_1T_2 = V_2T_1$ $\frac{V_1}{T_1} = \frac{V_2}{T_2}$	$\frac{P}{T} = k$ $P_1T_2 = P_2T_1$ $\frac{P_1}{T_1} = \frac{P_2}{T_2}$	$\frac{PV}{T} = k$ $V_1P_1T_2 = V_2P_2T_1$ $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

Dalton's Law	Ideal Gas Law	Graham's Law
At constant volume and temperature, the total pressure exerted by a mixture of gases is equal to the sum of the pressures exerted by each gas,	The Ideal Gas Law relates the pressure, temperature, volume, and mass of a gas through the gas constant "R".	The rate of effusion/diffusion of two gases (A and B) are inversely proportional to the square roots of their formula masses. [*It can be a ratio of molecular speeds, effusion /diffusion times, distance traveled by molecules, or amount of gas effused*]
$P_{total} = P_1 + P_2 + P_3 + ...P_n$	$PV = nRT$	$\frac{Rate_A}{Rate_B} = \frac{\sqrt{molar\ mass_B}}{\sqrt{molar\ mass_A}}$

Abbreviations	Standard Conditions
atm = atmosphere mm Hg = millimeters of mercury torr = another name for mm Hg Pa = Pascal kPa = kilopascal K = Kelvin °C = degrees Celsius	0°C = 273 K 1.00 atm = 760.0 mm Hg = 76 cm Hg =101.325 kPa = 101, 325 Pa = 29.9 in Hg
Conversions	**Gas Law's Equation Symbols**
K = °C + 273 $F^{\circ} = 1.8C^{\circ} + 32$ $C^{\circ} = \frac{F^{\circ} - 32}{1.8}$ 1 cm^3 (cubic centimeter) = 1 mL (milliliter) 1 dm^3 (cubic decimeter) = 1 L (liter) = 1000 mL	Subscript (1) = old condition or initial condition Subscript (2) = new condition or final condition Temperature must be in Kelvins n = number of moles = grams/Molar mass R = 8.31 L-kPa/ mol-K = 0.0821 L-atm/mol-K = 62.4 L-Torr/mol-K You must have a common set of units in the problem

1. Convert the following temperatures to K. a) 104 C b) -3 C	
2. Convert the following temperatures to C. a) 67 K b) 1671 K	
3. A sample of nitrogen gas has a volume of 478 cm^3 and a pressure of 104.1 kPa. What volume would the gas occupy at 88.2 kPa if the temperature remains constant?	
4. 8.98 dm^3 of hydrogen gas is collected at 38.8 °C. Find the volume the gas will occup at -39.9 °C if the pressure remains constant.	
5. A sample of gas has a volume of 215 cm^3 at 23.5 °C and 84.6 kPa. What volume will the gas occupy at STP?	

6. At a certain temperature, molecules of methane gas, CH_4 have an average velocity of 0.098 m/s. What is the average velocity of carbon dioxide molecules at this same temperature?	
7. Find the relative rate of diffusion for the gases chlorine, Cl_2 and ethane, C_2H_6.	
8. 495 cm^3 of oxygen gas and 877 cm^3 of nitrogen gas, both at 25.0 °C and 114.7 kPa, are injected into an evacuated 536 cm^3 flask. Find the total pressure in the flask, assuming the temperature remains constant.	
9. A sample of gas is transferred from a 75 mL vessel to a 500.0 mL vessel. If the initial pressure of the gas is 145 atm and if the temperature is held constant, what is the pressure of the gas sample in the 500.0 mL vessel?	
10. A sample of gas occupies a volume of 450.0 mL at 740 mm Hg and 16°C. Determine the volume of this sample at 760 mm Hg and 37°C.	

11. One mole of H_2S gas escapes from a container by effusion in 77 seconds. How long would it take one mole of NH_3 gas to escape from the same container?	
12. Convert a pressure of 0.0248 mm Hg to the equivalent pressure in pascals (Pa).	
13. Air in a closed cylinder is heated from 25°C to 36°C. If the initial pressure is 3.80 atm, what is the final pressure?	
14. A bubble of helium gas has a volume of 0.650 mL near the bottom of a large aquarium where the pressure is 1.54 atm and the temperature is 12°C. Determine the bubble's volume upon rising near the top where the pressure is 1.01 atm and 16°C.	
15. At what temperature Celsius will 19.4 g of molecular oxygen, O_2, exert a pressure of 1820 mm Hg in a 5.12 L cylinder?	

16. A sample of nitrogen gas, N_2, is collected in a100 mL container at a pressure of 688 mm Hg and a temperature of 565 °C. How many grams of nitrogen gas are present in this sample?	
17. What is the pressure in mm of Hg , of a gas mixture that contains 1g of H_2, and 8.0 g of Ar in a 3.0 L container at 27°C.	
18. To what temperature must 32.0 ft^3 of a gas at 2°C be heated for it to occupy 1.00 x 10^2 ft^3 at the same pressure?	
19. What is the pressure in atm exerted by 2.48 moles of a gas in a 250.0 mL container at 58°C?	
20. Determine the molar mass of a gas that has a density of 2.18 g/L at 66°C and 720 mm Hg. *(Hint: the number of moles of a substance is its mass/molecular mass and density is mass/volume.)*	

Key

1 a) 377 K
b) 270 K

2 a) -206 C
b) 1398 C

3. 564 cm^3

4. 6.71 dm^3

5. 165 cm^3

6. 0.059 m/s

7. rate Cl_2 : C_2H_6 = 0.650

8. 294 kPa

9. 21.8 atm

10.. 470 mL

11. 54 sec

12. 3.31 Pa

13. 3.94 atm

14. 1.00 mL

15. - 27°C

16. 0.0368 g

17. 4332 mm Hg

18. 586°C

19. 270 atm

20. 64 g/mole