Ideal Gas Law
Chem Worksheet 14-4

Name ___________________

The ideal gas law is an equation that relates the volume, temperature, pressure and amount of gas particles to a constant. The ideal gas constant is abbreviated with the variable *R* and has the value of 0.0821 atm·L/mol·K. The ideal gas law can be used when three of the four gas variables are known. When using this equation it is important that the units for **pressure** are atmospheres (atm), **volume** is in liters (L), and **temperature** is converted to kelvins (K). The **amount** of gas is measured in units called moles (mol).

USEFUL EQUATIONS

$PV = nRT$	1.00 atm = 101300 Pa
$R = 0.0821 \frac{atm \cdot L}{mol \cdot K}$	1.00 atm = 101.3 kPa
$T_K = T_C + 273$	1.00 atm = 760 mmHg
$1\ cm^3 = 1\ mL$	1.00 atm = 760 torr
1 L = 1000 mL	1.00 atm = 14.7 psi

Unknown	Equation	Known Variables
pressure	$P = \frac{nRT}{V}$	amount, temp., volume
volume	$V = \frac{nRT}{P}$	amount, temp., pressure
temperature	$T = \frac{PV}{nR}$	pressure, volume, amount
amount	$n = \frac{PV}{RT}$	pressure, volume, temp.

example

The pressure exerted by 2.8 moles of argon gas at a temperature of 85ºC is 420 torr. What is the volume of this sample?

- list the variables: $P = 420$ torr $V = ?$ $n = 2.8$ mol $R = 0.0821 \frac{atm \cdot L}{mol \cdot K}$ $T = 85ºC$
- convert the variables: $\frac{420\ \cancel{torr}}{1} \times \frac{1\ atm}{760\ \cancel{torr}} = 0.553\ atm$ $T = 85ºC + 273 = 358\ K$
- substitute into the equation: $V = \frac{nRT}{P}$ $V = \frac{(2.8\ \cancel{mol})(0.08206 \frac{\cancel{atm} \cdot L}{\cancel{mol} \cdot \cancel{K}})(358\ \cancel{K})}{0.553\ \cancel{atm}} = 82\ L$

Solve the following problems.

1. A tank contains 115 moles of neon gas. It has a pressure of 57 atm at a temperature of 45ºC. Calculate the volume of the tank.
2. A scuba tank has a pressure of 195 atm at a temperature of 10ºC. The volume of the tank is 350 L. How many moles of air are in the tank?
3. A helium-filled balloon has a volume of 208 L and it contains 9.95 moles of gas. If the pressure of the balloon is 1.26 atm, determine the temperature in Celsius degrees.
4. A tank of oxygen has a volume of 1650 L. The temperature of the gas inside is 35ºC. If there are 9750 moles of oxygen in the tank what is the pressure in PSI?
5. A canister of acetylene has a volume of 42 L. The temperature of the acetylene is 305 K and the pressure is 780 torr. Determine the amount (moles) of gas in the canister.
6. Calculate the volume of a CO_2 cartridge that has a pressure of 850 PSI at a temperature of 21ºC. The cartridge contains 0.273 mol of CO_2.
7. A tank contains 2500 L of argon gas. The pressure is13790 kPa and the temperature is 25ºC. How many moles of argon are in the tank?