Boyle's Law Practice Problems Name: Key Period: _____

Advanced Chemistry
Unit 7 Module 2 Practice Worksheet

Gas Law Word Problem	List all known variables (P, V, T or n) in this problem	List the unknown variable in this problem.	Write the name and formula of the appropriate Gas Law	Set up the gas law formula to solve for the unknown variable	Fill in gas law formula with known quantities and solve for unknown variable.	Final Answer is... (check your work!)
EXAMPLE A sample of nitrogen collected in a laboratory occupies a volume of 725 mL at a pressure of 0.971 atm. What volume will the gas occupy at a pressure of 1.40 atm, assuming the temperature remains constant?	V_1 = 725 mL P_1 = 0.971 atm P_2 = 1.40 atm 3 SF	*"What volume will the gas occupy?"* V_2 = ?	*Boyle's Law applies for these variables* $P_1V_1 = P_2V_2$	$\frac{P_1V_1}{P_2} = V_2$	$\frac{(0.971\text{atm})(725\text{mL})}{(1.40\ \text{atm})} = V_2$	V_2 = 503 mL 3 SF
A sample of neon gas occupies a volume of 2.8 L at 1.8 atm. What will its volume be at 1.2 atm?	V_1 = 2.8 L P_1 = 1.8 atm P_2 = 1.2 atm 2 SF	What will its volume Be V_2=?	*Boyle's Law applies for these variables* $\frac{P_1V_1}{P_2} = \frac{P_2V_2}{P_2}$	$V_2 = \frac{P_1V_1}{P_2}$	$V_2 = \frac{1.8\ \text{atm} \times 2.8\ \text{L}}{1.2\ \text{atm}}$	V_2 = 4.2 L 2 SF

Gas Law Word Problem	List all known variables (P, V, T or n) in this problem	List the unknown variable in this problem.	Write the name and formula of the appropriate Gas Law	Set up the gas law formula to solve for the unknown variable	Fill in gas law formula with known quantities and solve for unknown variable.	Final Answer is: (check your work!)
To what pressure would you have to compress 48.0 L of oxygen gas at 99.3 kPa in order to reduce its volume to 16.0 L?	$V_1 = 48.0\,L$ $P_1 = 99.3\,Kpa$ $V_2 = 16.0\,L$ 3 SF	to what Pressure? $P_2 = ?$	*Boyle's Law applies for these variables* $\frac{P_1V_1}{V_2} = \frac{P_2V_2}{V_2}$	$P_2 = \frac{V_1P_1}{V_2}$	$\frac{(99.3\ Kpa)(48.0\cancel{L})}{(16.0\cancel{L})} = P_2$	$P_2 = 297.9\ KPa$ $P = 298\ KPa$ 3 SF
A chemist collects 59.0 mL of sulfur dioxide gas on a day when the atmospheric pressure if 0.989 atm. On the next day, the pressure has changed to 0.967 atm. What will the volume of the SO_2 gas be on the second day?	$V_1 = 59.0\ mL$ $P_1 = 0.989\ atm$ $P_2 = 0.967\ atm$ 3 SF	$V_2 = ?$	$\frac{P_1V_1}{P_2} = \frac{P_2V_2}{P_2}$	$V_2 = \frac{P_1V_1}{P_2}$	$V_2 = \frac{(.989\ \cancel{atm})\cdot(59.0\ mL)}{0.967\ \cancel{atm}}$	$V_2 = 60.34\ mL$ $V_2 = 60.3\ mL$ 3 SF

Charles' Law Practice Problems Name: Key Period: _____

Advanced Chemistry
Unit 7 Module 2 Practice Worksheet

Gas Law Word Problem	List all known variables (P, V, T or n) in this problem	List the unknown variable in this problem.	Write the name and formula of the appropriate Gas Law	Set up the gas law formula to solve for the unknown variable	Fill in gas law formula with known quantities and solve for unknown variable.	Final Answer is... (check your work!)
EXAMPLE A container of oxygen has a volume of 349 mL at a temperature of 22°C. What volume will the gas occupy at 50.°C?	V_1 = 349 mL T_1 = 295 K T_2 = 323 K (Note: Celcius temperatures must be converted to Kelvin before using in gas law equations! K = °C + 273.15)	*"What volume will the gas occupy"* V_2 = ?	*Charles' Law applies here* $\frac{V_1}{T_1} = \frac{V_2}{T_2}$	$\frac{T_2 V_1}{T_1} = V_2$	$\frac{(323\ K)(349 mL)}{(295\ K)} = V_2$	V_2 = 382 mL
A balloon full of air has a volume of 2.75 L at a temperature of 18°C. What is the balloon's volume at 45°C? 18+273.15 45+273.15	V_1 = 2.75 L T_1 = 291 K T_2 = 318 K 3 SF	V_2=?	*Charles' Law applies here* $\frac{(T_2)V_1}{T_1} = \frac{V_2(T_2)}{T_2}$	$V_2 = \frac{V_1 T_2}{T_1}$	$V_2 = \frac{(2.75L)(318K)}{291K}$	V_2=3.00515 L V_2=3.01 L 3 SF

Gas Law Word Problem	List all known variables (P, V, T or n) in this problem	List the unknown variable in this problem	Write the name and formula of the appropriate Gas Law	Set up the gas law formula to solve for the unknown variable	Fill in gas law formula with known quantities and solve for unknown variable	Final Answer is: (check your work!)
A sample of argon has a volume of 0.43 mL at 24°C. At what temperature in degrees Celsius will it have a volume of 0.57 mL? 24+273.15	$V_1 = 0.43\ mL$ $T_1 = 297\ K$ $V_2 = 0.57\ mL$ 2 SF	$T_2 = ?$ (T in °C for final answer)	*Charles' Law applies here* $\frac{V_1}{T_1} = \frac{V_2}{T_2}$	$\frac{V_1 T_2}{V_1} = \frac{V_2 T_1}{V_1}$ $T_2 = \frac{V_2 T_1}{V_1}$	$\frac{(297\ K)(0.57\ mL)}{(0.43\ mL)} = T_2$	$T_2 = 393.698\ K$ 2 SF $T_2 = 340\ K$ -273.15 116.85 $T_2 = 120°C$
Helium gas in a balloon occupies 2.40L at 400. K. What volume will it occupy at 300. K? 3 SF	$V_1 = 2.40\ L$ $T_1 = 400.\ K$ $T_2 = 300.\ K$	$V_2 = ?$	$\frac{(T_2)V_1}{T_1} = \frac{V_2(T_2)}{T_2}$	$V_2 = \frac{V_1 T_2}{T_1}$	$V_2 = \frac{(2.40\ L)(300.\ K)}{400.\ K}$	$V_2 = 1.8\ L$ 3 SF $V_2 = 1.80\ L$

Gay-Lussac's Law Practice Problems Name: Key Period: _____

Advanced Chemistry
Unit 7 Module 2 Practice Worksheet

Gas Law Word Problem	List all known variables (P, V, T or n) in this problem	List the unknown variable in this problem.	Write the name and formula of the appropriate Gas Law	Set up the gas law formula to solve for the unknown variable	Fill in gas law formula with known quantities and solve for unknown variable.	Final Answer is... (check your work!)
EXAMPLE A cylinder of gas has a pressure of 4.40 atm at 25°C. At what temperature in °C will it reach a pressure of 6.50 atm?	$P_1 = 4.40$ atm $T_1 = 298$ K $P_2 = 6.50$ atm (Note: Celsius temperatures must be converted to Kelvin before using in gas law equations! K = °C + 273.15)	*"At what temperature in degrees Celcius will it reach a pressure of"* $T_2 = ?$ °C	*Gay-Lussac's Law applies here* $\frac{P_1}{T_1} = \frac{P_2}{T_2}$	First, cross multiply to get T_2 out of the denominator. $P_1T_2 = P_2T_1$ Then isolate T_2. $\frac{P_2T_1}{P_1} = T_2$	$\frac{(6.50\ \text{atm})(298\ \text{K})}{(4.40\ \text{atm})} = T_2$	$T_2 = 440.$ K Now, convert back to Celcius. $T_2 = 167$ °C
A cylinder of compressed gas has a pressure of 4.882 atm on one day. The next day, the same cylinder of gas has a pressure of 4.690 atm, and its temperature is 8°C. What was the temperature on the previous day in °C? 8°C + 273.15	$P_1 = 4.882$ atm $T_2 = 281$ $P_2 = 4.690$ atm 3 SF	$T_1 = ?$°C	*Gay-Lussac's Law applies here* $\frac{P_1}{T_1} = \frac{P_2}{T_2}$ (P₁ and T₂ crossed out) $\frac{P_2T_1}{P_2} = \frac{P_1 \cdot T_2}{P_2}$ $T_1 = \frac{P_1T_2}{P_2}$		$T_1 = \frac{(4.882)(281\ \text{K})}{4.690\ \text{atm}}$	$T_1 = 292.50$ K 3 SF $T_1 = 293$ K -273.15 20 $T_1 = 20$°C

Gas Law Word Problem	List all known variables (P, V, T or n) in this problem	List the unknown variable in this problem	Write the name and formula of the appropriate Gas Law	Set up the gas law formula to solve for the unknown variable	Fill in gas law formula with known quantities and solve for unknown variable	Final Answer is... (check your work!)
A mylar balloon is filled with helium gas to a pressure of 107 kPa when the temperature is 22°C. If the temperature changes to 45°C, what will be the pressure of the helium in the balloon? 22 | +273 | 15 = 295 | 15 45 | +273 | 15 = 318 | 15	$P_1 = 107$ kPa $T_1 = 295$ K $T_2 = 318$ K 3 SF	$P_2 = ?$	*Gay-Lussac's Law applies here* $\frac{(T_2)P_1}{T_1} = \frac{P_2(T_2)}{T_2}$	$P_2 = \frac{P_1 T_2}{T_1}$	$\frac{(318\ K)(107\ kPa)}{(295\ K)} = P_2$	$P_2 = 115.34$ kPa $P_2 = 115$ kPa 3 SF
A sample of hydrogen at 47°C exerts a pressure of 0.329 atm. The gas is heated to 77°C at constant volume. What will its new pressure be? 47 | +273 | 15 = 320 | 15 77 | +273 | 15 = 350 | 15	$T_1 = 320.$ K $P_1 = 0.329$ atm $T_2 = 350.$ K 3 SF	$P_2 = ?$	$\frac{(T_2)P_1}{T_1} = \frac{P_2(T_2)}{T_2}$	$P_2 = \frac{P_1 T_2}{T_1}$	$P_2 = \frac{(0.329\ atm)(350.\ K)}{(320.\ K)}$	$P_2 = 0.3598$ atm $P_2 = 0.360$ atm 3 SF

Avogadro's Law Practice Problems Name: Key Period: _____

Advanced Chemistry
Unit 7 Module 2 Practice Worksheet

Gas Law Word Problem	List all known variables (P, V, T or n) in this problem	List the unknown variable in this problem.	Write the name and formula of the appropriate Gas Law	Set up the gas law formula to solve for the unknown variable	Fill in gas law formula with known quantities and solve for unknown variable.	Final Answer is... (check your work!)
EXAMPLE At standard temperature and pressure, a gas occupies a volume of 1.84 L. How many moles of this gas are present at STP?	V = 1.84 L @ STP	*"How many moles of this gas are present at STP?"* n = ?	*Avogadro's Law applies for these variables* 1 mole of any gas @STP = 22.4 L	N/A - no equation, a simple dimensional analysis conversion	$\frac{1.84\ \text{L}}{} \times \frac{1\ \text{mole}}{22.4\ \text{L}}$ 1.84 ÷ 22.4 = 0.082142857 moles	n = 0.0821 moles (Answer has 3 SF b/c you start w/ 3 SF)
What volume (in Liters) will 0.524 moles of Nitrogen (N_2) occupy at STP?	n = 0.524 moles @ STP	V = ? L	*Avogadro's Law applies for these variables* 1 mole of any gas @STP = 22.4 L	N/A - no equation, a simple dimensional analysis conversion	$\frac{0.524\ \text{moles}}{} \times \frac{22.4\ \text{L}}{1\ \text{mole}}$ = 11.7376 L	V = 11.7 L

Gas Law Word Problem	List all known variables (P, V, T or n) in this problem	List the unknown variable in this problem	Write the name and formula of the appropriate Gas Law:	Set up the gas law formula to solve for the unknown variable	Fill in gas law formula with known quantities and solve for unknown variable.	Final Answer is: (Check your work!)
A chemist produces 0.712 moles of H_2S during a reaction. At STP, what volume in Liters will this gas occupy at STP	n = 0.712 moles @ STP	V = ? L	*Avogadro's Law applies for these variables* 1 mole of any gas @STP = 22.4 L	N/A - no equation, a simple dimensional analysis conversion	$\frac{0.712\,\text{mol} \mid 22.4\,\text{L}}{1\,\text{mol}}$ = 15.9488 L	V = 15.9 L
A sample of gas occupies a volume of 681 Liters at STP. How many moles of this gas are present at STP?	V = 681 L @ STP	# moles = ?	Avogadro's 1 mole = 22.4 L	N/A - no equation, a simple dimensional analysis conversion	$\frac{681\,\text{L} \mid 1\,\text{mole}}{22.4\,\text{L}}$ = 30.40178...	n = 30.4 moles
5.00 L of gas is known to contain 0.965 mol. If the amount of gas is increased to 1.80 mol, what volume will the gas occupy?	V_1 = 5.00 L n_1 = 0.965 mol n_2 = 1.80 mol	V_2 = ?	Avogadro's $\frac{V_1}{n_1} = \frac{V_2}{n_2}$	$V_2 = \frac{n_2 \cdot V_1}{n_1}$	$V_2 = \frac{(1.80\,\text{mol}) \cdot 5.00\,\text{L}}{0.965\,\text{mol}}$ V_2 = 9.326....	V_2 = 9.33 L

1. **What does the "STP" abbreviation represent?** Standard Temperature + Pressure
2. **What is standard temperature in degrees Celcius? Kelvin?** 0°C, 273K
3. **What is standard atmospheric pressure in atm? kPa? mmHg?** 0°C, 101.325 kPa, 760 mmHg
4. **What is molar volume?** 1 mole = 22.4 L @ STP

Gas Laws - Mixed Practice Problems **Name:** Key **Period:** _____

Advanced Chemistry
Unit 7 Module 2 Practice Worksheet

Gas Law Word Problem	List all known variables (P, V, T or n) in this problem	List the unknown variable in this problem.	Write the name and formula of the appropriate Gas Law	Set up the gas law formula to solve for the unknown variable	Fill in gas law formula with known quantities and solve for unknown variable.	Final Answer is... (check your work!)
A hot-air balloon has a volume of 1.05 x 10^4 L if the temperature is 25°C. However, when the balloon rises, the temperature decreases to 13°C. What is the new volume?	$V_1 = 1.05 \times 10^4$ L $T_1 = 25 + 273 = 298$ K $T_2 = 13 + 273 = 286$ K	$V_2 = ?$	Charles' Law $\frac{V_1}{T_1} = \frac{V_2}{T_2}$	$V_2 = \frac{T_2 \cdot V_1}{T_1}$	$V_2 = \frac{(286\text{K}) \cdot (1.05 \times 10^4\text{L})}{298\text{K}}$ $V_2 = 10,077.18121$ Liters	$V_2 = 1.01 \times 10^4$ L
What pressure will be needed to reduce the volume of 77.4 L of helium at 98.0 kPa to a volume of 60.0 L?	$V_1 = 77.4$ L $P_1 = 98.0$ KPa $V_2 = 60.0$ L	$P_2 = ?$	Boyle's Law $P_1V_1 = P_2V_2$	$P_2 = \frac{P_1V_1}{V_2}$	$P_2 = \frac{(98.0\text{KPa}) \cdot (77.4\text{K})}{60.0\text{K}}$ $P_2 = 126.42$ KPa	$P_2 = 126$ KPa

Gas Law Word Problem	List all known variables (P, V, T or n) in this problem	List the unknown variable in this problem	Write the name and formula of the appropriate Gas Law	Set up the gas law formula to solve for the unknown variable	Fill in gas law formula with known quantities and solve for unknown variable	Final Answer is... (check your work!)
A sample of hydrogen at 47°C exerts a pressure of 0.329 atm. The gas is heated to 77°C at constant volume. What will its new pressure be?	$T_1 = 47 + 273 = 320.\text{K}$ $P_1 = 0.329\ \text{atm}$ $T_2 = 77 + 273 = 350.\text{K}$	$P_2 = ?$	Gay-Lussac's Law $\frac{P_1}{T_1} = \frac{P_2}{T_2}$	$P_2 = \frac{P_1 \cdot T_2}{T_1}$	$P_2 = \frac{(0.329\ \text{atm}) \cdot (350.\text{K})}{320.\text{K}}$ $P_2 = 359.84375\ \text{atm}$	$P_2 = 360\ \text{atm}$
If 0.81 moles of gas occupies 14.7 L of space under a particular set of conditions, how many moles will be needed to occupy 50.0 L of space under the same conditions?	$n_1 = 0.81\ \text{mol}$ $V_1 = 14.7\text{L}$ $V_2 = 50.0\text{L}$	$n_2 = ?$	Avogadro's Law $\frac{V_1}{n_1} = \frac{V_2}{n_2}$	$n_2 = \frac{V_2 \cdot n_1}{V_1}$	$n_2 = \frac{(50.0\text{L}) \cdot (0.81\ \text{mol})}{14.7\text{L}}$ $n_2 = 2.75510\ldots\ \text{mol}$	$n_2 = 2.8\ \text{mol}$
How many moles are present in a sample of CO_2 gas that has a volume of 1.87 L measured at standard temperature and pressure?	$V = 1.87\text{L}$ @ STP	$n = ?\ \text{mol}$	Avogadro's Law $1\ \text{mole} = 22.4\ \text{L}$ @ STP	N/A	$\frac{1.87\text{L}}{} \mid \frac{1\ \text{mol}}{22.4\text{L}}$ $= 0.08348\ldots\ \text{mol}$	$n = 0.0835\ \text{mol}$