

Gas Laws Problem Packet

Gas Laws Packet

Name _____ Date _____ Period _____

Essentials

Standard Constant:

Unit	Standard Pressure
atm	1.013
mmHg	760
cm Hg	760
torr	760
atm	1.013

22.4 L = 1 mol at STP

STP (Standard Temperature and Pressure) = 0°C and 1 atm

The gas laws:

Boyle's Law:	$P_1V_1 = P_2V_2$
Charles's Law:	$\frac{V_1}{T_1} = \frac{V_2}{T_2}$
Gay-Lussac's Law:	$\frac{P_1}{T_1} = \frac{P_2}{T_2}$
Avogadro's Law:	$\frac{V_1}{n_1} = \frac{V_2}{n_2}$
Combined Gas Law:	$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
Graham's Law:	$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$

The constant R (used in the other gas laws) depends on the units of Pressure:

- 1 atm, R = 0.0821 $\frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}}$
- 1 atm, R = 0.0821 $\frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}}$

Always Remember:

- Temperature must always be in Kelvin! ($K = ^\circ\text{C} + 273$)
- If you are given two different units of pressure, CONVERT!
- Create two columns before solving, initial and final, write what you're given in the problem. Find the law that uses the variables you're given, and solve for the unknown. (for Ideal Gas Law, write what you're given, insert those in equation and solve for unknown)
- Avogadro's Law: DON'T FORGET TO USE MOLE! (MAYBE!)
- Graham's Law: You will ALWAYS have the molecular mass for these problems. Double and triple check you have the mole of effluent and molecular mass in the correct spots before solving the equation! (this is an INVERSE relationship, you MUST calculate the square root of double both sides of the equation before moving things)

Charles' Law $V \propto T$

Directions: Complete each of the problems below. Show your work for all of the problems and include units for all answers.

- The temperature inside my refrigerator is about 4°C. If I place a balloon in the refrigerator, will the volume of the balloon increase or decrease? Explain your answer. (10 points)
- A balloon is inflated to a volume of 2.0 L at 25°C. If the temperature is lowered to 10°C, what will the volume of the balloon be? (10 points)

Gay-Lussac's Law $P \propto T$

Directions: Complete each of the problems below. Show your work for all of the problems and include units for all answers.

- A gas is held at a constant volume of 2.0 L and a pressure of 1.0 atm. If the temperature is increased from 25°C to 50°C, what will the pressure be? (10 points)
- A gas is held at a constant volume of 2.0 L and a pressure of 1.0 atm. If the temperature is decreased from 25°C to 10°C, what will the pressure be? (10 points)

Boyle's Law $P \propto \frac{1}{V}$

Directions: Complete each of the problems below. Show your work for all of the problems and include units for all answers.

- A gas is held at a constant temperature of 25°C and a pressure of 1.0 atm. If the volume is increased from 2.0 L to 4.0 L, what will the pressure be? (10 points)
- A gas is held at a constant temperature of 25°C and a pressure of 1.0 atm. If the volume is decreased from 2.0 L to 1.0 L, what will the pressure be? (10 points)

Avogadro's Law $V \propto n$

Directions: Complete each of the problems below. Show your work for all of the problems and include units for all answers.

- A gas is held at a constant temperature and pressure of 25°C and 1.0 atm. If the volume is 2.0 L and the number of moles is 1.0 mol, what will the volume be if the number of moles is increased to 2.0 mol? (10 points)
- A gas is held at a constant temperature and pressure of 25°C and 1.0 atm. If the volume is 2.0 L and the number of moles is 1.0 mol, what will the volume be if the number of moles is decreased to 0.5 mol? (10 points)

Combined Gas Law $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

Directions: Complete each of the problems below. Show your work for all of the problems and include units for all answers.

- A gas is held at a constant number of moles and a pressure of 1.0 atm. If the volume is 2.0 L and the temperature is 25°C, what will the volume be if the temperature is increased to 50°C? (10 points)
- A gas is held at a constant number of moles and a pressure of 1.0 atm. If the volume is 2.0 L and the temperature is 25°C, what will the volume be if the temperature is decreased to 10°C? (10 points)

Graham's Law $\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$

Directions: Complete each of the problems below. Show your work for all of the problems and include units for all answers.

- Gas A has a molecular mass of 4.0 g/mol and a rate of effusion of 1.0 mol/min. Gas B has a molecular mass of 16.0 g/mol. What will the rate of effusion of Gas B be? (10 points)
- Gas A has a molecular mass of 4.0 g/mol and a rate of effusion of 1.0 mol/min. Gas B has a molecular mass of 16.0 g/mol. What will the rate of effusion of Gas B be? (10 points)

All Gas Laws Included!

Keystone
science



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BM King



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