**The Combined Gas Law Equation**

**YOYO:** Use Table A on your reference table and your knowledge of chemistry to answer the following questions.

1. What is standard pressure? Standard temperature?
2. What unit of temperature must be used when completing gas law questions?
3. What are the three variables studied in the combined gas law equation?
4. What is the relationship between volume and pressure?
5. What is the relationship between volume and temperature?
6. What is the relationship between temperature and pressure?

Important Combined Gas Law Info

* All three gas laws can be combined into one equation, hence the name “Combined Gas Law” and the formula according to Table T is:

The Combined Gas Law Equation

* When working on a gas law question:
  + Write down all the variables given in the question
    - Sometimes all 3 variables are used in the question and sometimes only 2 are used
  + You can ignore a variable if it is not stated in the question, or if the question says it is kept constant
  + Plug in values into the equation and solve for the missing piece
  + Make sure temperature is in KELVIN!
  + When it says STP, look at Table A on the Reference Table for the values

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| **Example #1:** A gas occupies 1.00 L at standard temperature. What is the volume at 330.0 °C?  *Knowns & Unknowns Plug Values into Equation*  P1 = \_\_\_\_\_\_ P2 = \_\_\_\_\_\_  V1 = \_\_\_\_\_\_ V2 = \_\_\_\_\_\_  T1 = \_\_\_\_\_\_ T2 = \_\_\_\_\_\_ |
| **Example #2**: If a gas in a closed container is pressurized from 15 atm to 16 atm and its original temperature was 200 K, what is the final temperature of the gas?  *Knowns & Unknowns Plug Values into Equation*  P1 = \_\_\_\_\_\_ P2 = \_\_\_\_\_\_  V1 = \_\_\_\_\_\_ V2 = \_\_\_\_\_\_  T1 = \_\_\_\_\_\_ T2 = \_\_\_\_\_\_ |
| **Example #3:** A container holds 500. mL of CO2 gas at 742 torr. What will be the volume of the CO2 gas if the pressure is increased to 795 torr?  *Knowns & Unknowns* *Plug Values into Equation*  P1 = \_\_\_\_\_\_ P2 = \_\_\_\_\_\_  V1 = \_\_\_\_\_\_ V2 = \_\_\_\_\_\_  T1 = \_\_\_\_\_\_ T2 = \_\_\_\_\_\_ |
| **Example #4:** A rigid cylinder with a movable piston contains a sample of gas. At 300. K, this sample has a pressure of 240. kilopascals and a volume of 70.0 milliliters. What is the volume of this sample when the temperature is changed to 150. K and the pressure is changed to 160. kilopascals?  *Knowns & Unknowns Plug Values into Equation*  P1 = \_\_\_\_\_\_ P2 = \_\_\_\_\_\_  V1 = \_\_\_\_\_\_ V2 = \_\_\_\_\_\_  T1 = \_\_\_\_\_\_ T2 = \_\_\_\_\_\_ |

**Practice Time:** Use the models to help you answer these questions.

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| 1. A cylinder with a movable piston contains a sample of gas having a volume of 6.0 liters at 293 K and 1.0 atmosphere. What is the volume of the sample after the gas is heated to 303 K, while the pressure is held at 1.0 atmosphere? |
| 1. A rigid cylinder contains a sample of gas at STP. What is the pressure of this gas after the sample is heated to 410 K? |
| 1. 1,400.0 L of N2 gas at a pressure of 1.25 atm has its pressure changed to 17.5 atm at constant temperature. What will be its new volume at the pressure? |
| 1. H2 gas occupies a volume of 400.0 mL at 27.00C. Find the volume it will occupy if the temperature is increased to 57.00C at constant pressure? |
| 1. A sample of gas occupies a volume of 50.0 milliliters in a cylinder with a movable piston. The pressure of the sample is 0.90 atmosphere and the temperature is 298 K. What is the volume of the sample at STP? |
| 1. A rigid cylinder with a movable piston contains a 2.0-liter sample of neon gas at STP. What is the volume of this sample when its temperature is increased to 30°C while its pressure is decreased to 90. kilopascals? |
| 1. A 220.0-mL sample of helium gas is in a cylinder with a movable piston at 105 kPa and 275 K. The piston is pushed in until the sample has a volume of 95.0 mL. The new temperature of the gas is 310. K. What is the new pressure of the sample? |