**Gas Law Graphing**

**YOYO**:

* Look at Table T on your reference table and find the equation that deals with temperature:
  + The Equation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Use that equation to convert temperatures.
  + Celsius 🡪 Kelvin
    - 15 °C = \_\_\_\_\_\_\_\_\_
    - 100 °C = \_\_\_\_\_\_\_\_\_
    - 0 °C = \_\_\_\_\_\_\_\_\_
    - 38 °C = \_\_\_\_\_\_\_\_\_

**Boyle’s Law**

Robert Boyle (1627-1691), an English chemist, discovered that doubling the pressure of an enclosed sample of gas while keeping its temperature constant caused the volume of the gas to be reduced by half. Boyle’s Law states that the volume of a given mass of gas varies inversely with the pressure when the temperature is kept constant. An inverse relationship means that as one variable increases in value, the other variable decreases.

|  |  |
| --- | --- |
| **Pressure (mmHg)** | **Volume (mL)** |
| 1200 | 380 |
| 600 | 760 |
| 300 | 1520 |
| 200 | 2280 |
| 150 | 3040 |
| 100 | 4560 |

Questions:

1. What does Boyle’s Law state?
2. What happens to the volume when the pressure is *increased*? *Decreased?*
3. What happens to the pressure when the volume is *increased*?
4. What type of relationship is this?

**Charles’ Law**

French physicist Jacques Charles (1746-1823) studied the effect of temperature on the volume of a gas at constant pressure. Charles’s Law states that the volume of a given mass of gas varies directly with the absolute temperature of the gas when the pressure is kept constant. The absolute temperature is temperature measured with the Kelvin scale. The Kelvin scale must be used because zero on the Kelvin scale corresponds to a complete stoppage of molecular motion.

|  |  |
| --- | --- |
| **Temperature (K)** | **Volume (mL)** |
| 700 | 1400 |
| 601 | 1202 |
| 499 | 998 |
| 401 | 802 |
| 300 | 600 |
| 199 | 398 |
| 100 | 200 |

Questions:

1. What does Charles’ Law state?
2. What happens to the volume when the temperature is *increased*? *Decreased?*
3. What happens to the temperature when the volume is *increased*? *Decreased?*
4. What type of relationship is this?

**Gay-Lussac’s Law**

French chemist, Joseph Gay-Lussac (1778-1850), discovered the relationship between the pressure of a gas and its absolute temperature. **Gay-Lussac’s Law** states that the pressure of a given mass of gas varies directly with the absolute temperature of the gas when the volume is kept constant. Gay-Lussac’s Law is very similar to Charles’s Law, with the only difference being the type of container. Whereas the container in a Charles’s Law experiment is flexible, it is rigid in a Gay-Lussac’s Law experiment.

|  |  |
| --- | --- |
| **Temperature (K)** | **Pressure (atm)** |
| 100 | 0.2632 |
| 150 | 0.3947 |
| 200 | 0.5263 |
| 300 | 0.7895 |
| 400 | 1.0526 |
| 450 | 1.1842 |

Questions

1. What does Gay-Lussac’s Law state?
2. What happens to the pressure when the temperature is *increased*? *Decreased?*
3. What happens to the temperature when the pressure is *increased*? *Decreased?*
4. What type of relationship is this?

**The Combined Gas Law**

* 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
  + If a variable is constant, you can ignore it
  + Plug in values into the equation and solve for the missing piece
  + Make sure temperature is in KELVIN!
* **Challenge:** Try the following questions on a separate sheet of paper. Rewrite the questions and show all work. These are to be collected and is homework if you don’t finish!
  + A gas occupies 1.00 L at standard temperature. What is the volume at 330.0 °C?
  + 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?
  + A container holds 500. mL of CO2 gas at 742 torr. What will be the volume of the CO2 gas if the pressure is increases to 795 torr?