Thermal energy can drastically affect the properties of a gas. Have you ever wondered why a balloon in a hot car will expand? Or why air has to be released from car tires in the summer and added in the winter? The reason for these physical phenomena can be explained using the gas laws, which will be explored using sensor technology.

Ideal gas law: PV=nRT, where:

n = number of moles

R = universal gas constant = 8.3145 L\*kPa/mol\*K

P= pressure (kPa)

V= volume (L)

T= Temperature (Kelvin)

Tasks include:

1. collection of data: at least 10 data points should be collected, additional data points can be recorded on a separate sheet, be sure to include units on all data points.
2. graphs of data collected: include labels, key, and data points
3. analysis questions: answer using data and graphs
4. practice problems: solve the problems using your reference table.

**Set-up**

Connect TI Sensor Tag to your mobile device and ensure sensor is operational by checking for data measurements. If any issues arise, troubleshoot any issues before data collection to ensure accurate data.

**Task 1: Data Collection**

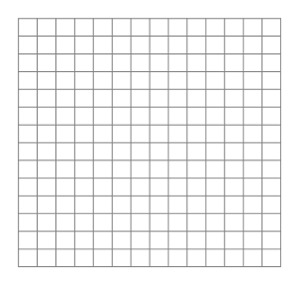
Data Collection Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

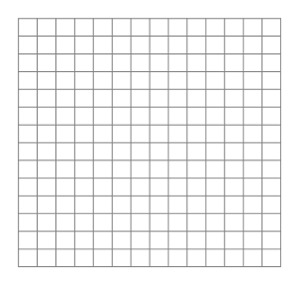
Remember to convert temperature data from degrees Celsius to Kelvin, and pressure from hectoPascal to Pascals to atmosphere.

Data Chart

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Measurement | Ambient Temperature (℃) | Ambient Temperature (K) | Pressure (hPa) | Pressure (hPa) | Pressure (atm) |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6 |  |  |  |  |  |
| 7 |  |  |  |  |  |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |
| 10 |  |  |  |  |  |
| Average of Data Points |  |  |  |  |  |

**Task 2: Graphs**

Temperature Pressure

**Task 3: Analysis Questions**

1. How do temperature and pressure affect the ideal gas law?
2. What variables need to be considered while conducting experiments?
3. Did anything unexpected occur during the experiment? If so, what was the cause?
4. Create an ideal gas law calculation utilizing an average of the data you collected.
5. What are some real world applications of the gas laws?

**Task 4: Practice Problems**

1. A gas occupies 1.56 L at 1.00 atm. What will be the volume of this gas if the pressure becomes 3.00 atm?
2. At 27.00 °C a gas has a volume of 6.00 L. What will the volume be at 150.0 °C?
3. If a gas in a closed container is pressurized from 15.0 atmospheres to 16.0 atmospheres and its original temperature was 25.0 °C, what would the final temperature of the gas be?
4. 5.00 L of a gas is known to contain 0.965 mol. If the amount of gas is increased to 1.80 mol, what new volume will result (at an unchanged temperature and pressure)?
5. How many moles of a gas would be present in a gas trapped within a 37.0 liter vessel at 80.00 °C at a pressure of 2.50 atm?