HPS Gas Laws Calcs 2021 Name: Per:

Objective 4: Demonstrate the relationships between pressure, moles, volume, and temperature of a confined gas.

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|  | **Boyle’s Law** | **Gay-Lussac’s Law** | **Charles’s Law** |
| **Equation** | P1V1 = P2V2 | P1 = P2  T1 T2 | V1  = V2  T1  T2 |
| **Relationship** | Inverse | Direct | Direct |
| **Units** | Volume: cm3, m3, L    Pressure: atm, kPa, mm Hg | Temperature: Kelvin  \*C + 273 = K  Pressure: atm, kPa, mm Hg | Temperature: Kelvin  \*C + 273 = K  Volume: cm3, m3, L |

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| **Combined Gas Law**: P1V1 = P2V2  T1  T2  (This law combines the three laws above. It can be helpful to memorize just one equation rather than three separate ones. Use when the mass of the gas is fixed.) | **Ideal Gas Law**: PV = nRT  where n is moles and R is a constant:  8.314 L\*kPa/mol\*K or 0.0821 L\*atm/mol\*K  A **mole** is **defined** as 6.02214076 × 1023 of some **chemical** unit, be it atoms, molecules, ions, or others. The **mole** is a convenient unit to use because of the great number of atoms, molecules, or others in any substance. |

1. In a thermonuclear device, the pressure of 0.050 liters of gas within the bomb casing reaches 4.0 x106 atm. When the bomb casing is destroyed by the explosion, the gas is released into the atmosphere where it reaches a pressure of 1.00 atm. What is the volume of the gas after the explosion?

2. Synthetic diamonds can be manufactured at pressures of 6.00 x 104 atm. If we took 2.00 liters of gas at 1.00 atm and compressed it to a pressure of 6.00 x 104 atm, what would the volume of that gas be?

3. The temperature inside my refrigerator is about 4.00 Celsius. If I place a balloon in my fridge that initially has a temperature of 220 C and a volume of 0.50 liters, what will be the volume of the balloon when it is fully cooled by my refrigerator?

4. How hot will a 2.3 L balloon have to get to expand to a volume of 400.0 L? Assume that the initial temperature of the balloon is 25 0C.

5. If I have an unknown quantity of gas at a pressure of 1.2 atm, a volume of 31.0 liters, and a temperature of 87 0C, how many moles of gas do I have?

6. Atmospheric pressure on the peak of Mt. Everest can be as low as 150 mm Hg, which is why climbers need to bring oxygen tanks for the last part of the climb. If the climbers carry 10.0 liter tanks with an internal gas pressure of 3.04 x 104 mm Hg, what will be the volume of the gas when it is released from the tanks?

7. If I have 7.7 moles of gas at a pressure of 0.09 atm and at a temperature of 56 0C, what is the volume of the container that the gas is in?

8. On hot days, you may have noticed that potato chip bags seem to “inflate”, even though they have not been opened. If I have a 250 mL bag at a temperature of 19 0C, and I leave it in my car which has a temperature of 60.00 C, what will the new volume of the bag be?

9. If I contain 3.0 moles of gas in a container with a volume of 60.0 liters and at a temperature of 400.0 K, what is the pressure inside the container?

10. A soda bottle is flexible enough that the volume of the bottle can change even without opening it. If you have an empty soda bottle (volume of 2.0 L) at room temperature (25 0C), what will the new volume be if you put it in your freezer (-4.0 0C)?

11. If I have 4.0 moles of a gas at a pressure of 5.6 atm and a volume of 12 liters, what is the temperature?

12. Submarines need to be extremely strong to withstand the extremely high pressure of water pushing down on them. An experimental research submarine with a volume of 15,000 liters has an internal pressure of 1.2 atm. If the pressure of the ocean breaks the submarine forming a bubble with a pressure of 250.0 atm pushing on it, how big will that bubble be?