**Chemistry – Pressure Unit Conversions, Boyles, Charles, Combined Gas Laws**

**1 atm = 760 mm Hg = 101.325 Pa = 14.7 lb/in2 = 1.013 bar**

1. The air pressure for a certain tire is 109 kPa. What is this pressure in atmospheres?
2. The air pressure inside a submarine is 0.62 atm. What would be the height of a column of mercury balanced by this pressure?
3. The weather news gives the atmospheric pressure as 1.07 atm. What is this pressure in mm Hg?
4. An experiment at Sandia National Labs in New Mexico is performed at 758.7mm Hg. What is this pressure in atm?
5. A bag of potato chips is sealed in a factory near sea level. The atmospheric pressure and the pressure inside the bag is 761.3 mm Hg. What is the pressure inside the bag in Pa?
6. The same bag of chips from problem 5 is shipped to Denver, where the atmospheric pressure is 99.82 kPa. What is the difference between the pressure in the bag and the atmospheric pressure?

Boyle’s Law

1. If I have 5.6 liters of gas in a piston at a pressure of 1.5 atm and compress the gas until its volume is 4.8 L, what will the new pressure inside the piston be?
2. I have added 15 L of air to a balloon at sea level (1.0 atm). If I take the balloon with me to Denver, where the air pressure is 0.85 atm, what will the new volume of the balloon be?
3. I’ve got a car with an internal volume of 12,000 L. If I drive my car into the river and it implodes, what will be the volume of the gas when the pressure goes from 1.0 atm to 1.4 atm?

Charles’ Law

1. If I have 45 liters of helium in a balloon at 25°C and increase the temperature of the balloon to 55° C, what will the new volume of the balloon be?
2. Calcium carbonate decomposes at 1200° C to form carbon dioxide and calcium oxide. If 25 liters of carbon dioxide are collected at 1200° C, what will the volume of this gas be if it cools to 25° C?
3. I have 130 liters of gas in a piston at a temperature of 250° C. If I cool the gas until the volume decreases to 85 liters, what will temperature of the gas be?

Combined Gas Law

1. If I have 4.0 L of a gas at a pressure of 1.1 atm, what will the volume be if the pressure is 3.4 atm?
2. A toy balloon has an internal pressure of 1.05 atm and a volume of 5.0 L. If the temp where the balloon is released is 20° C, what will happen to the volume when the balloon rises to an altitude where the pressure is 0.65 atm and the temperature is –15° C?
3. A small research submarine with a volume of 1.2 x 105 L has a pressure of 1.0 atm and al temp of 15° C. If the submarine descends to a depth where the pressure is 150 atm and the temp is 3° C, what will the volume of the gas inside be if the hull of the submarine breaks?
4. People who are angry sometimes say that they feel as if they’ll explode. If a calm person with a lung capacity of 3.5 liters and a body temperature of 36° C gets angry, what will the volume of the person’s lungs be if their temperature rises to 39° C? Do you think it’s likely they will explode?
5. A bag of potato chips is packaged at sea level (1.00 atm) and has a volume of 315 mL. If this bag of chips is transported to Denver (0.775 atm), what will the new volume of the bag be?
6. A Los Angeles class nuclear submarine has a volume of 11,000,000 L at a pressure of 1.250 atm. If a crewman were to open one of the hatches to the outside ocean while it was underwater (pressure = 15.75 atm), what would be the new volume of the air inside the submarine?
7. A child has a balloon with a volume of 1.80 liters. The temp when the balloon was filled was 20° C, the pressure was 1.00 atm. If the child let go of the balloon and it rose 3 km into the sky where the pressure is 0.667 atm and the temp is -10° C, what would the new volume of the balloon be?

20. A commercial airliner has an internal pressure of 1.00 atm and temperature of 25° C at takeoff. If the temperature of the airliner drops to 17° C during the flight, what is the new cabin pressure?