Name_____ Date_____ Hour____

Gas Laws Practice – Written by Students

$PV = nRT$

1) An unopened water bottle has a temperature of 5.00°C and a pressure of 2.00 atm. After it was put in the freezer the temperature lowered to −1.00°C. What was the pressure of the water bottle after being put into the freezer?

$T_1 + 273.15 = 278.15\,K$ P_1 $T_2 + 273.15 = 272.15\,K$ P_2

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$ $\quad \frac{2.00\ atm}{278.15\,K} = \frac{P_2}{272.15\,K}$

Amontons

$P_2 = 1.96\ atm$

2) A ball contained 20.3 L of air at a temperature of 30.0°C. The ball was brought inside, where the temperature is 40.0°C. Calculate the change in volume.

V_1 $T_1 + 273.15 = 303.15\,K$ $T_2 + 273.15 = 313.15\,K$ V_2

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\quad \frac{20.3\,L}{303.15\,K} = \frac{V_2}{313.15\,K}$

Charles

$V_2 = 21.0\,L$

Change in Volume

$21.0\,L - 20.3\,L = 0.7\,L$ Increase

3) A balloon has a volume of 57.0 L when held at a pressure of 15.0 atm. When taken to a pressure of 23.0 atm, what is the new volume?

V_1 P_1 P_2 V_2

$P_1V_1 = P_2V_2$ $\quad \frac{(15.0\ atm)(57.0\,L)}{23.0\ atm} = \frac{(23.0\ atm)(V_2)}{23.0\ atm}$

Boyle's

$V_2 = 37.2\,L$

4) On a hot day of 40.0°C on a camping trip, my air mattress has a volume of 67.0 L and 2.73 moles of gas when I first blew it up. After three days of sleeping on it, it had lost 20.0 L of its volume. How many moles of gas were left in my mattress after three days?

V_1 n_1 n_2

$67.0\,L - 20.0\,L = V_2\ 47.0\,L$

$\frac{V_1}{n_1} = \frac{V_2}{n_2}$ $\quad \frac{67.0\,L}{2.73\,mol} = \frac{47.0\,L}{n_2}$

Avogadro's

$n_2 = 1.92\ mol$

5) How hot of temperature will a 2.40 L bubble have to get to in order to expand to a volume of 200.0 L? Assume that the initial temperature of the bubble is at 15.0°C.

V_1 V_2 $T_1 + 273.15 = 288.15\,K$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\quad \frac{2.40\,L}{288.15\,K} = \frac{200.0\,L}{T_2}$

Charles'

$T_2 = 24{,}000\,K$

6) One day in the land of Shawnland, a girl named Hanna was trying to find the volume of a balloon after a pressure change. The original volume and pressure were 2.00 L and 3.00 atm. If the pressure is reduced to 1.10 atm, without a change in temperature, what is the new volume of the balloon?

$P_1V_1 = P_2V_2$

$\frac{(3.00\text{ atm})(2.00\text{ L})}{1.10\text{ atm}} = \frac{(1.10\text{ atm})V_2}{1.10\text{ atm}}$

Boyle's

$V_2 = 5.45\text{ L}$

7) A 33.0 L ball contains 9.80 moles of gas. If 17.0 L of gas are removed from the ball, how many moles remain?

$V_2 = 33.0 - 17.0 = 16.0\text{ L}$

$\frac{V_1}{n_1} = \frac{V_2}{n_2}$

$\frac{33.0\text{ L}}{9.80\text{ mol}} = \frac{16.0\text{ L}}{n_2}$

Avogadro's

$n_2 = 4.75\text{ mol}$

$T_2 = 353.15\text{ K}$

8) The number of moles and volume of a gas are being held constant in a tire. At 80.0°C, the pressure of the tire is at 1230 KPa. What was the pressure when the temperature was at 40.0°C.

$T_1 = 313.15\text{ K}$

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$

$\frac{P_1}{313.15\text{ K}} = \frac{1230\text{ kPa}}{353.15\text{ K}}$

Amontons

$P_1 = 1090\text{ kPa}$

$T_1 = 307.95\text{ K}$

9) If I have 24.6 L of gas at a temperature of 34.8°C and a pressure of 45.8 atm, what will the temperature of the gas be if the pressure increases to 123 atm and the volume decreases to 17.8 L?

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$\frac{(45.8\text{ atm})(24.6\text{ L})}{307.95\text{ K}} = \frac{(123\text{ atm})(17.8\text{ L})}{T_2}$

Combined

$T_2 = 598\text{ K}$

$T = 308.05\text{ K}$

10) Find the number of moles of CO_2 gas if you have 6.98 L of it at 34.9°C and a pressure of 0.91 atm. ALSO, calculate the number of molecules of CO_2 gas.

$\frac{PV}{RT} = \frac{nRT}{RT}$

$n = \frac{PV}{RT}$

$n = \frac{(0.91\text{ atm})(6.98\text{ L})}{(0.0821\frac{\text{atm}\cdot\text{L}}{\text{mol}\cdot\text{K}})(308.05\text{ K})}$

Ideal

$n = 0.251\text{ mol } CO_2$

$\frac{6.02\times10^{23}\text{ molecules } CO_2}{1\text{ mol } CO_2} \left| \frac{0.251\text{ mol } CO_2}{} \right. = 1.51\times10^{23}\text{ molecules } CO_2$