Date:_____ Period_____ Name:_____

Chapter 13 Gas Laws

Homework #1 Answers

Match the mathematical expression with the name of the law.

1. C Boyle's Law
2. A Gay-Lussac's Law
3. D Charles's Law
4. B Ideal Gas Law
5. E Combined law

a) $P_1/T_1 = P_2/T_2$

b) $P_1V_1/n_1T_1 = P_2V_2/n_2T_2$ (or $PV=nRT$)

c) $P_1V_1 = P_2V_2$

d) $V_1/T_1 = V_2/T_2$

"Same" Law

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

Solve the following problems. Show all work.

This is Combined Law

1. A sample of gas occupies 9.00 L at 1.90 atm and 308 K. Find its volume when it is held at conditions of STP.

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ initial = Final condition

$9.00L = V_1$ $\quV_2 = ?$

$1.90atm = P_1$ $\quP_2 = 1atm$

$308K = T_1$ $\quT_2 = 273K$

$\frac{(1.90atm)(9L)}{308K} = \frac{(1atm)(V_2)}{273K}$

$V_2 = 15.2\ L$

2. What happens to pressure of the gas in a vessel whose temperature has been doubled? (Assume constant volume.) That is, by what factor does it go up or go down? The P will double. It goes up by a factor of two.

3. If you bring a sealed bag of potato chips with you on an airplane, the bag may pop after the plane takes off. Why? I have noticed that if the bag doesn't pop in the first few minutes, then the bag is not likely to pop at all during the flight. Why? My mom always packs her cosmetics and stuff (bottles of lotion, bottles of shampoo, bottles of perfume, etc.) in zip-lock bags if she plans to travel by airplane. Why? (Two short sentences will suffice here.) High altitude = low pressure = bigger volume. The P in the airplane is lower than 1 atm, but it is maintained at ≈ 0.8 atm. As P in airplane decreases, the air in cosmetics bottles will expand, often pushing the liquid products out as a result.

4. A small balloon that looks just like a sealed bag of potato chips has a volume of 0.750 L when the atmospheric pressure is 1.00 atm. Find the new volume of the balloon when the pressure is decreased to 0.90 atm. (Assume that the temperature doesn't change.)

$P_1 = 1atm$ $\quP_2 = .90atm$ $\quP_1V_1 = P_2V_2$

$V_1 = .75\ L$ $\quV_2 = ?$ $\quad(1)(.75) = (.9)V_2$

$0.83\ L = V_2$

5. How many grams of hydrogen (remember: it's diatomic!) gas are there in a vessel that has a volume of 482.0 mL? The gas has a pressure of 442 mm Hg and a temperature of 38.2 °C. (Strategy hint: solve for # of moles first.)

Strategy! Find moles, then find grams.

$P = 442mmHg \times \frac{1atm}{760mmHg} = 0.582\ atm$

$V = 482\ mL = 0.4820\ L$

$T = 38.2°C + 273 = 311.2K$

$R = 0.0821\ \frac{Latm}{Kmol}$

$n = \frac{PV}{RT} = \frac{(582)(.482)}{(.0821)(311)}$

$= 0.01078mol \times \frac{2.02\ g}{1mol} = 0.0222g$