Name KEY Period _____ Page # _____

Intro to Gas Laws Student Practice Page

Instructions: List the variables down the left side, solve the equation for the unknown variable and write it on the left before substituting.

Boyle's Law: $P_1V_1 = P_2V_2$

1. A 224 mL sample of argon had its pressure changed from 95.0 kPa to 185 kPa. What is its new volume?

$P_1 = 95\ kPa$

$V_1 = 224\ mL$

$P_2 = 185\ kPa$

$V_2 = ?$

Eq: $V_2 = \frac{P_1V_1}{P_2}$

$V_2 = \frac{(95\ kPa)(224\ mL)}{(185\ kPa)} = 115\ mL$

2. Chlorine gas occupies a volume of 2.3 liters at 180 kPa pressure. What volume will it occupy at 1.0 atm pressure?

$V_1 = 2.3\ L$

$P_1 = 180\ kPa$

$V_2 = ?$

$P_2 = 1.0\ atm = 101.3\ kPa$ (1 standard atmosphere, convert to kPa)

Eq: $V_2 = \frac{P_1V_1}{P_2}$

$V_2 = \frac{(180\ kPa)(2.3\ L)}{(101.3\ kPa)} = 4.1\ L$

3. Nitrogen gas occupies a volume of 270. mL at a pressure of 730. mmHg. What volume will it occupy at <u>standard pressure</u>?

$V_1 = 270.\ mL$

$P_1 = 730\ mm\ Hg$

$V_2 = ?$

$P_2 = 760\ mm\ Hg$ (standard pressure in the same units)

Eq: $V_2 = \frac{P_1V_1}{P_2}$

$V_2 = \frac{(730.\ mm\ Hg)(270.\ mL)}{(760.\ mm\ Hg)} = 259\ mL$

Charles' Law: $V_1T_2 = V_2T_1$ (or $\frac{V_1}{T_1} = \frac{V_2}{T_2}$)

4. Argon occupies a volume of 3.4 liters at -145°C. What volume will it occupy at 25°C?

$V_1 = 3.4\ L$

$T_1 = -145°C = 128\ K$ (convert to Kelvin by ~~subtracting~~ adding 273)

$V_2 = ?$

$T_2 = 25°C = 298\ K$

Eq: $V_2 = \frac{V_1T_2}{T_1}$

$V_2 = \frac{(3.4\ L)(298\ K)}{(128\ K)} = 7.9\ L$

Intro to Gas Laws Student Practice Page (continued)

5. A sample of argon gas is cooled and its volume went from 885 mL to 550. mL. If its final temperature was -95.0°C, what was its original temperature in °C?

$V_1 = 885\,mL$ convert to Kelvin → then back
$T_1 = ?$
$V_2 = 550\,mL$
$T_2 = -95.0°C = 178\,K$

EQ: $T_1 = \frac{V_1 T_2}{V_2}$

$T_1 = \frac{(885\,mL)(178\,K)}{(550\,mL)} = 286\,K = \boxed{13°C}$

6. Helium gas was cooled from 270. K to 50. K. Its new volume is 25 mL. What was its original volume?

$T_1 = 270.\,K$
$V_1 = ?$
$V_2 = 25\,mL$
$T_2 = 50.\,K$

EQ: $V_1 = \frac{V_2 T_1}{T_2}$

$V_1 = \frac{(25\,mL)(270.\,K)}{(50.\,K)} = \boxed{135\,mL}$

Dalton's Law: $P_T = P_1 + P_2 + P_3...$, etc. *(be sure all pressures are in the same units)*

7. The partial pressure of fluorine gas is 0.723 atm. The partial pressure of hydrogen gas is 88.2 kPa. What is the total pressure of the container in atmospheres?

$P_{TOTAL} = ?$
$P_1 = 0.723\,atm$
$P_2 = 88.2\,kPa \left| \frac{1\,atm}{101.3\,kPa} \right. = 0.871\,atm$

Convert all pressures to common units (atm) before adding/subtracting

$P_T = 0.723\,atm + 0.876\,atm$
$P_T = \boxed{1.599\,atm}$

Sig Figs → we know both to 0.001

8. A container of gas has a total pressure of 22.1 psi. If the pressure of one gas is 950. torr, what is the pressure of the missing gas in kPa?

$P_T = 22.1\,atm \left| \frac{101.3\,kPa}{14.7\,psi} \right. = 152\,kPa$

$P_1 = 950.\,torr \left| \frac{101.3\,kPa}{760\,torr} \right. = 127\,kPa$

convert both to the common units asked for in the answer

$P_2 = ?$
$P_2 = P_T - P_1 = 152\,kPa - 127\,kPa = \boxed{25\,kPa}$