States of Matter and Gas Laws Review Sheet

1) What would the temperature of a gas be if a 0.268 mole sample occupied a volume of 7290 mL at a pressure of 1.83atm?

$P = 1.83\text{ atm}$

$V = 7290\text{ mL} \mid \frac{1\text{ L}}{1000\text{ mL}} = 7.29\text{ L}$

$n = 0.268\text{ mol}$

$R = 0.0821\ \frac{\text{L·atm}}{\text{mol·K}}$

$T = X\text{ K}$

$PV = nRT$ ideal

$(1.83)(7.29) = (0.268)(0.0821)(X)$

$13.3407 = 0.0220028X$

$606\text{ K} = T$

2) What would be the volume (in mL) of an ideal gas if a 0.245 mole sample had a temperature of 20°C at a pressure of 988.5 mm Hg?

$P = 988.5\text{ mmHg} \mid \frac{1\text{ atm}}{760\text{ mmHg}} = 1.30\ldots\text{ atm}$

$V = X\text{ L} \rightarrow \text{mL}$

$n = 0.245\text{ mol}$

$R = 0.0821\ \frac{\text{L·atm}}{\text{mol·K}}$

$T = 20°\text{C} + 273 = 293\text{K}$

$PV = nRT$ ideal

$(1.30\ldots)(X) = (0.245)(0.0821)(293)$

$1.30\ldots(X) = 5.8935485$

$X = 4.53\text{ L} \mid \frac{1000\text{ mL}}{1\text{ L}} = 4530\text{ mL}$

3) A gas takes up a volume of 17 liters, has a pressure of 2.3 atm, and a temperature of 299 K. If I raise the temperature to 350 K and lower the pressure to 1.5 atm, what is the new volume of the gas?

$P_1 = 2.3\text{atm}$ $P_2 = 1.5\text{atm}$

$V_1 = 17\text{L}$ $V_2 = X\text{ L}$

$T_1 = 299\text{K}$ $T_2 = 350\text{K}$

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

$\frac{(2.3)(17)}{299} = \frac{(1.5)(X)}{350}$

$13685 = 448.5X$

$X = V_2 = 31\text{L}$

4) What would be the pressure if a 0.753 mole sample of carbon dioxide gas occupied a volume of 8110 mL at a temperature of 82.5°C?

$P = x$ atm

$V = 8110\ mL \left| \frac{1\ L}{1000\ mL} \right. = 8.11\ L$

$n = 0.753$ mol

$R = 0.0821 \frac{L \cdot atm}{mol \cdot K}$

$T = 82.5^{\circ}C + 273 = 355.5\ K$

$PV = nRT$ ideal

$(x)(8.11) = 0.753\,(0.0821)(355.5)$

$8.11x = 21.97747215$

$x = \boxed{P = 2.71\ atm}$

5) A gas that has a volume of 28 L, a temperature of 45 ^{0}C, and an unknown pressure, has its volume increased to 34 L and its temperature decreased to 35 ^{0}C. If the pressure measured after this change is 2.0 atm, what was the original pressure of the gas?

$P_1 = x$ atm

$V_1 = 28\ L$

$T_1 = 45^{\circ}C + 273 = 318\ K$

$P_2 = 2.0$ atm

$V_2 = 34\ L$

$T_2 = 35^{\circ}C + 273 = 308\ K$

combined

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

$$\frac{(x)(28)}{318} = \frac{(2.0)(34)}{308}$$

$8624x = 21624$

$x = \boxed{P_1 = 2.5\ atm}$

6) If 4.77 moles of a gas at a pressure of 5.4 atm has a volume of 120 mL, what is the temperature?

$P = 5.4$ atm

$V = 120\ mL \left| \frac{1\ L}{1000\ mL} \right. = 0.12\ L$

$n = 4.77$ mol

$R = 0.0821 \frac{L \cdot atm}{mol \cdot K}$

$T = x\ K$

$PV = nRT$ ideal

$(5.4)(0.12) = (4.77)(0.0821)(x)$

$0.648 = 0.391617x$

$x = \boxed{T = 1.7\ K}$

7) If I initially have a gas with a pressure of 845 kPa and a temperature of 35.0° C and I heat it an additional 230 degrees, what will the new pressure be? Assume the volume of the container is constant.

$P_1 = 845\ kPa$ $\quad P_2 = X\ kPa$

~~$V_1 =$~~ $\quad$ ~~$V_2 =$~~

$T_1 = 35.0°C + 273 = 308K$ $\quad T_2 = 265°C + 273 = 538K$

$\frac{P_1 \cancel{V_1}}{T_1} = \frac{P_2 \cancel{V_2}}{T_2}$ gay-lussac

$\frac{845}{308} = \frac{X}{538}$

$454610 = 308X$

$P_2 = 1480\ kPa$

8) My car has an internal volume of 2600 liters. If the sun heats my car from a temperature of 20° C to a temperature of 55° C, what will the pressure inside my car be? Assume the pressure was initially 760 mm Hg.

$P_1 = 760\ mmHg$

~~$V_1 = 2600L$~~

$T_1 = 20°C + 273 = 293K$

$P_2 = X\ mmHg$

~~$V_2 = 2600L$~~

$T_2 = 55°C + 273 = 328K$

$\frac{P_1 \cancel{V_1}}{T_1} = \frac{P_2 \cancel{V_2}}{T_2}$ gay-lussac

$\frac{760}{293} = \frac{X}{328}$

$249280 = 293X$

$850\ mmHg$

9) How many moles of gas are in my car in problem #8?

$P = 760mmHg = 1atm$

$V = 2600L$

$n = X\ mol$

$R = 0.0821 \frac{L \cdot atm}{mol \cdot K}$

$T = 293K$

$PV = nRT$ ideal

$(1)(2600) = (X)(0.0821)(293)$

$2600 = 24.0553X$

$X = n = 110 mols$

10) A sealed canister contains three gasses. Gas A has a partial pressure of 1.4 atm. Gas B has a partial pressure of 0.44 atm. If the total pressure of the gasses is 3.75 atm, what is the partial pressure of gas C?

$P_{tot} = P_A + P_B + P_C$ Dalton's law

$P_{tot} = 3.75 atm$

$P_A = 1.4 atm$

$P_B = 0.44 atm$

$P_C = X atm$

$3.75 = 1.4 + 0.44 + X$

$3.75 = 1.84 + X$

$X = P_C = 1.91 atm$

$P_C = 1.9 atm$

11) Which of the soda containers below would be most likely to spew soda if you opened it? Show work to explain. highest pressure!

$PV = nRT$ ideal

$R = 0.0821 \frac{L \cdot atm}{mol \cdot K}$

b/c highest P!

T = 22.4°C +273 = 295.4K
P = ? atm
V = 354 ml $\frac{1L}{1000mL}$ = 0.354L
n = 1.66 mol CO_2

$(X)(0.354) = (1.66)(0.0821)(295.4)$

$0.354X = 40.255888$

$X = P = 114 atm$

T = 46.7°C +273 = 319.7K
P = ? atm
V = 2.0 L
n = 2.33 mol CO_2

$(X)(2.0) = (2.33)(0.0821)(319.7)$

$2X = 61.15637$

$X = P = 31 atm$

T = 19.3°C +273 = 292.3K
P = ? atm
V = 244 ml $\frac{1L}{1000mL}$ = 0.244L
n = 1.83 mol CO_2

$(X)(0.244) = (1.83)(0.08$ (292

$0.244X = 43.916$

$P = 180. atm$

12) Explain why a scuba diver might die if he/she rose too quickly (ascends) to the surface after a deep dive.

surface

PTV

↑ pressure decreases

B/C as pressure decreases, the volume of the lungs & gases in the blood increase.

P↓, V↑

13) A bicycle tire is filled with air to a pressure of 750.9 mm Hg at a temperature of 19°C. Riding the bike on a hot Texas day increases the temperature of the tire to 58°C. The volume of the tire increases by 4.0%. What is the new pressure in the bicycle tire?

$P_1 = 750.9 mmHg$ $P_2 = X\ mmHg$

$V_1 = 100L$ $V_2 = 104L$

$T_1 = 19°C + 273 = 292K$ $T_2 = 58°C + 273 = 331K$

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

$\frac{(750.9)(100)}{292} = \frac{(X)(104)}{331}$

$24854.790 = 30368X$

$X = P_2 = 820\ mmHg$

Helpful Advice: *Be sure to also study your notes for ALL concepts! This review was focusing on the math concepts of the unit, but that is not the ONLY thing we learned.*

Remember: *P T V*

alphabetically!