

Name _____

Per _____

Date _____

Use your knowledge of the ~~ideal or combined~~ gas laws to solve the following problems.

- 1) If four moles of a gas at a pressure of 5.4 atmospheres have a volume of 120 liters, what is the temperature? $(PV = nRT)$

$$n = 4$$

$$P = 5.4 \text{ atm}$$

$$V = 120 \text{ L}$$

$$T = ?$$

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

$$(5.4 \text{ atm})(120 \text{ L}) = (4 \text{ mol})(0.0821 \frac{\text{L} \cdot \text{atm}}{\text{K} \cdot \text{mol}}) T$$

$$(4 \text{ mol})(0.0821 \frac{\text{L} \cdot \text{atm}}{\text{K} \cdot \text{mol}}) \frac{(5.4 \text{ atm})(120 \text{ L})}{(4 \text{ mol})(0.0821 \frac{\text{L} \cdot \text{atm}}{\text{K} \cdot \text{mol}})}$$

$$T = 1973 \text{ K}$$

- 2) If I initially have a gas with a pressure of 840 mmHg and a temperature of 35°C and I heat it an additional 230 degrees, what will the new pressure be? Assume the volume of the container is constant. $(\frac{P_1}{T_1} = \frac{P_2}{T_2})$

$$P_1 = 840 \text{ mmHg}$$

$$T_1 = 35^\circ\text{C} + 273 = 308 \text{ K}$$

$$P_2 = ?$$

$$T_2 = 35^\circ\text{C} + 230^\circ\text{C} + 273 = 538 \text{ K}$$

$$\frac{(840 \text{ mmHg})}{(308 \text{ K})} = \frac{P_2}{(538 \text{ K})}$$

$$P_2 = 1467 \text{ mmHg}$$

- 3) My airtight 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. $(\frac{P_1}{T_1} = \frac{P_2}{T_2})$

$$V = 2600 \text{ L}$$

$$T_1 = 20^\circ\text{C} + 273 = 293 \text{ K}$$

$$T_2 = 55^\circ\text{C} + 273 = 328 \text{ K}$$

$$P_1 = 760 \text{ mmHg}$$

Volume stays the same

$$P_2 = 851 \text{ mmHg}$$

- 4) How many moles of gas are in my car in problem #3?

You either need to use $P_1 \hat{=} T_1$ or $P_2 \hat{=} T_2$ b/c # moles doesn't change, or Volume doesn't change

$$PV = nRT$$

$$(760 \text{ mmHg})(2600 \text{ L}) = n (62.4 \frac{\text{L} \cdot \text{mmHg}}{\text{K} \cdot \text{mol}}) (293 \text{ K})$$

$$P_1 = 760 \text{ mmHg}$$

$$T_1 = 293 \text{ K}$$

$$V_1 = 2600 \text{ L}$$

$$n = ?$$

$$R = 62.4 \frac{\text{L} \cdot \text{mmHg}}{\text{K} \cdot \text{mol}}$$

$$n = 108 \text{ moles}$$

Ideal Gas Law

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- 5) A toy balloon filled with air has an internal pressure of 1.25 atm and a volume of 2.50 L. If I take the balloon to the bottom of the ocean where the pressure is 95 atmospheres, what will the new volume of the balloon be? How many moles of gas does the new balloon hold? (Assume $T = 285\text{ K}$) ← doesn't change

$$P_1 = 1.25 \text{ atm}$$

$$V_1 = 2.50 \text{ L}$$

$$P_2 = 95 \text{ atm}$$

$$V_2 = ?$$

$$(1.25 \text{ atm})(2.50 \text{ L}) = V_2(95 \text{ atm})$$

$$V_2 = 0.33 \text{ L}$$

$$P_1 V_1 = P_2 V_2$$

- 6) What mole of fluorine gas is contained in a 96 mL container at 27.0°C and 785 atm?

$$n = ?$$

$$V = 96 \text{ mL} = 0.096 \text{ L}$$

$$T = 27^\circ\text{C} + 273 = 300 \text{ K}$$

$$P = 785 \text{ atm}$$

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

$$(785 \text{ atm})(0.096 \text{ L}) = n(0.0821)(300 \text{ K})$$

$$n = 3.06 \text{ moles}$$

- 7) If 26.0 mL of a gas at 27.0°C has a pressure of 15.5 atm, what would be the volume of the gas, in L, at STP? $\Rightarrow 0^\circ\text{C}$ & 1 atm

$$V_1 = 26 \text{ mL} = 0.026 \text{ L}$$

$$T_1 = 27^\circ\text{C} + 273 = 300 \text{ K}$$

$$P_1 = 15.5 \text{ atm}$$

$$V_2 = ?$$

$$T_2 = 0^\circ\text{C} + 273 = 273 \text{ K}$$

$$P_2 = 1 \text{ atm}$$

$$\frac{(15.5 \text{ atm})(0.026 \text{ L})}{(300 \text{ K})} = \frac{(1 \text{ atm})(V_2)}{(273 \text{ K})}$$

$$V_2 = 0.37 \text{ L}$$

$$\frac{P_1 \times V_1}{T_1} = \frac{P_2 \times V_2}{T_2}$$

- 8) What is the pressure in atm of 2 moles of neon gas in a 44.6 L container at 27.0°C ?

$$P = ?$$

$$n = 2 \text{ mol}$$

$$V = 44.6 \text{ L}$$

$$T = 27^\circ\text{C} + 273 = 300 \text{ K}$$

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

$$P(44.6 \text{ L}) = (2 \text{ mol})(0.0821 \frac{\text{L}\cdot\text{atm}}{\text{K}\cdot\text{mol}})(300 \text{ K})$$

$$P = 1.10 \text{ atm}$$

- 9) What volume would 28.02 g of nitrogen gas, N_2 , occupy at STP?

$$\text{molar mass } \text{N}_2 = 28 \text{ g/mol}$$

$$n = \frac{28.02 \text{ g}}{28 \text{ g}} = 1 \text{ mol}$$

$$P = 1 \text{ atm}$$

$$V = ?$$

$$T = 273 \text{ K}$$

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

$$(1 \text{ atm})V = (1 \text{ mol})(0.0821)(273 \text{ K})$$

$$V = 22.4 \text{ L}$$

- 10) A steel tank containing acetylene gas at standard temperature has a pressure of 45.0 atm. If a fire causes the temperature to rise to 327°C , what will be the new pressure?

$$T_1 = 273 \text{ K}$$

$$P_1 = 45 \text{ atm}$$

$$T_2 = 327^\circ\text{C} + 273 = 600 \text{ K}$$

$$P_2 = ?$$

$$\frac{45 \text{ atm}}{273 \text{ K}} = \frac{P_2}{600 \text{ K}}$$

$$P_2 = 98.9 \text{ atm}$$

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