

(23)

$$PV = nRT$$

(a) $P = 782 \text{ mmHg}$ $V = ?$ $n = .210 \text{ mol}$
 $T = 27^\circ\text{C}$ or 300K

$$R = .0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$$

$$V = \frac{nRT}{P}$$

$$\frac{.210 \cancel{\text{mol}} \cdot .0821 \frac{\text{L} \cdot \text{atm}}{\cancel{\text{mol}} \cdot \text{K}} \cdot 300 \cancel{\text{K}}}{782 \cancel{\text{mmHg}} \cdot \frac{1 \text{atm}}{760 \cancel{\text{mmHg}}}}$$

$$V = 5.03 \text{ L} \sim \text{Book } 5.02 \text{ L}$$

(b) $P = ? \text{ mmHg}$ $V = 644 \text{ mL}$ $n = .0921 \text{ mol}$
 $T = 303 \text{ K}$

$$P = \frac{nRT}{V}$$

$$R = .0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$$

$$\frac{.0921 \cancel{\text{mol}} \cdot .0821 \frac{\text{L} \cdot \text{atm}}{\cancel{\text{mol}} \cdot \text{K}} \cdot 303 \cancel{\text{K}}}{644 \cancel{\text{mL}} \cdot \frac{1 \text{L}}{1000 \cancel{\text{mL}}}}$$

$$\left[\begin{array}{l} 2700 \text{ mm} \\ 2.70 \times 10^3 \text{ mmHg} \end{array} \right] \text{ or } \left[3.56 \text{ atm} \right]$$

23 c $P = 745 \text{ mmHg}$ $V = 11.2 \text{ L}$
 $n = .401 \text{ mol}$ $T = ? \text{ K}$

$$PV = nRT \quad T = \frac{PV}{nR}$$

745 mmHg	11.2 L	mol K	1 atm
	$.401 \text{ mol}$	$.0821 \text{ L} \cdot \text{atm}$	760 mmHg

$T = 333 \text{ K} \text{ or } 334 \text{ K (Boyle)}$

24. a $P = 1.01 \text{ atm}$ $V = ?$ $n = .00831 \text{ mol}$
 $T = 25^\circ\text{C} \text{ or } 298 \text{ K}$

$$V = \frac{nRT}{P}$$

$$R = .0821 \text{ L} \cdot \text{atm} / \text{mol} \cdot \text{K}$$

$.00831 \text{ mol}$	$.0821 \text{ L} \cdot \text{atm}$	298 K
$\text{mol} \cdot \text{K}$		1.01 atm

$V = .201 \text{ L}$

24.6

$$P = ? \text{ atm} \quad V = 602 \text{ mL}$$

$$n = 8.01 \times 10^{-3} \text{ mol} \quad T = 310 \text{ K}$$

$$P = \frac{nRT}{V}$$

$$R = \frac{.0821 \text{ L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$$

$$\frac{8.01 \times 10^{-3} \text{ mol}}{1} \times \frac{.0821 \text{ L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} \times \frac{310 \text{ K}}{1} \times \frac{1000 \text{ mL}}{602 \text{ mL}} \times \frac{1 \text{ L}}{1000 \text{ mL}}$$

$$P = .339 \text{ atm or } .338 \text{ (Book)}$$

24.7

$$P = .998 \text{ atm} \quad V = 629 \text{ mL} \quad n = ?$$

$$T = 35^\circ \text{C} = 308 \text{ K}$$

$$PV = nRT$$

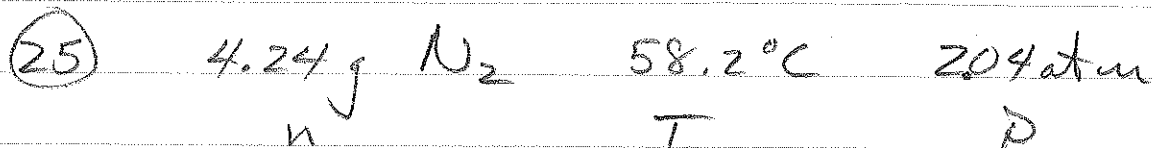
$$n = \frac{PV}{RT}$$

$$R = \frac{.0821 \text{ L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$$

$$\frac{.998 \text{ atm}}{1} \times \frac{629 \text{ mL}}{1} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{1 \text{ mol} \cdot \text{K}}{.0821 \text{ L} \cdot \text{atm}} \times \frac{308 \text{ K}}{1}$$

$$n = .0248 \text{ mol}$$

1



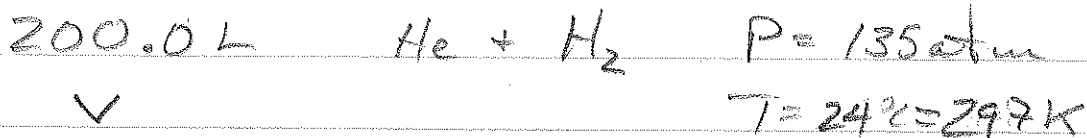
$$V = \frac{nRT}{P} \quad R = \frac{.0821 \text{ L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$$

molar mass of N_2 $14.00 \times 2 = 28.00 \text{ g/mol}$

$$\frac{4.24 \text{ g}}{28.00 \text{ g/mol}} \times \frac{.0821 \text{ L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} \times \frac{331.2 \text{ K}}{2.04 \text{ atm}}$$

$$V = 2.02 \text{ L} \quad \text{or} \quad 2.01 \text{ L (Book)}$$

(26)



$n?$ $n = \frac{VP}{RT}$ $R = \frac{.0821 \text{ L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$

$$\frac{200.0 \text{ L}}{135 \text{ atm}} \times \frac{.0821 \text{ L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} \times 297 \text{ K}$$

1

$$n = 1170 \text{ mol}$$

$$2.00 \text{ g H}_2 =$$

$$\frac{1}{2} \text{ mol}$$

$$4.00 \text{ g/mol He} =$$

$$2220 \text{ g H}_2$$

$$4440 \text{ g He}$$

(27) $T = ?$ 16.3 g N_2 $P = 1.25 \text{ atm}$

$V = 25.0 \text{ L}$

$R = .0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$

$T = \frac{PV}{nR}$

molar mass N_2 $\frac{14.00 \times 2}{28.00 \text{ g/mol}}$

$\frac{1.25 \text{ atm} \times 25.0 \text{ L}}{.0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}} \times \frac{28.00 \text{ g/mol}}{16.3 \text{ g}}$

$T = 654 \text{ K}$ Boor 654 K

(28) $P = ?$ $V = 125 \text{ L}$ 56.2 kg O_2
 $T = 21^\circ \text{C} = 294 \text{ K}$

molar mass $O_2 = \frac{16.00 \times 2}{32.00 \text{ g/mol}}$

$P = \frac{nRT}{V}$

$\frac{56.2 \text{ kg} \times 1000 \text{ g}}{1 \text{ kg}} \times \frac{1 \text{ mol}}{32.00 \text{ g}} \times .0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} \times 294 \text{ K}$

$P = 339 \text{ atm}$ Boor 340. atm

(29) Combined Gas Law will solve this problem!

However the ideal gas law can be used.

$$PV = nRT$$

$$\frac{P_1 V_1}{n_1 T_1} = R \quad \text{since } R \text{ never changes}$$

$$\frac{P_2 V_2}{n_2 T_2} = R$$

Thus

$$\frac{P_1 V_1}{n_1 T_1} = \frac{P_2 V_2}{n_2 T_2}$$

Now any change in P, V, T , or n can be calculated!

$$\Rightarrow V_2 = ? \quad V_1 = 125 \text{ mL He} \quad T_1 = 100^\circ\text{C} = 373 \text{ K}$$

$$P_1 = .981 \text{ atm}$$

$$T_2 = 25^\circ\text{C} = 298 \text{ K} \quad P_2 = 1.15 \text{ atm}$$

(Continued)

$$\frac{P_1 V_1}{n_1 T_1} = \frac{P_2 V_2}{n_2 T_2} \quad \text{solve for } V_2$$

$$\frac{n_2 T_2 P_1 V_1}{n_1 T_1 P_2} = V_2 \quad \text{Now } n_1 = n_2$$

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

$$\frac{298\text{K}}{373\text{K}} \times \frac{0.981\text{atm}}{1.15\text{atm}} \times 125\text{mL}$$

$$V_2 = 85.2\text{mL}$$

30 Use

$$\frac{P_1 V_1}{n_1 T_1} = \frac{P_2 V_2}{n_2 T_2}$$

$$V_2 = ?$$

$$V_1 = 459\text{mL}$$

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

$$P_1 = 1.05\text{atm}$$

$$T_2 = 15^\circ\text{C} = 288\text{K}$$

$$P_2 = .997\text{atm}$$

$$n_1 = n_2$$

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

$$\frac{288\text{K}}{300\text{K}} \times \frac{1.05\text{atm}}{.997\text{atm}} \times 459\text{mL}$$

$$V_2 = 464\text{mL} \quad \text{(Book)} \quad 465\text{mL}$$