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(23) $PV = nRT$

(a) $P = 782\ mm\ Hg$ $V = ?$ $n = .210\ mol$

$T = 27°C$ or $300K$

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

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

$$\frac{.210\ mol}{} \left| \frac{.0821\ L \cdot atm}{mol \cdot K} \right| \frac{300\ K}{} \left| \frac{}{782\ mm\ Hg} \right| \frac{760\ mm\ Hg}{1\ atm}$$

$V = 5.03\ L$ ~ Both $5.02\ L$

(b) $P = ?\ mm\ Hg$ $V = 694\ mL$ $n = .0921\ mol$

$T = 303\ K$

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

$$\frac{.0921\ mol}{} \left| \frac{.0821\ L \cdot atm}{mol \cdot K} \right| \frac{303\ K}{} \left| \frac{}{694\ mL} \right| \frac{1000\ mL}{1\ L} \left| \frac{760\ mm\ Hg}{1\ atm} \right.$$

$2700\ mm$

$2.70 \times 10^3\ mm\ Hg$ or $3.56\ atm$

(23 c) P = 745 mm Hg, V = 11.2 L
n = .401 mol, T = ? K

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

$\frac{745\ mm\ Hg}{} \cdot \frac{11.2\ L}{} \cdot \frac{}{.401\ mol} \cdot \frac{mol\ K}{.0821\ L \cdot atm} \cdot \frac{1\ atm}{760\ mm\ Hg}$

T = 333 K or 334 K (Book)

(24. a) P = 1.01 atm, V = ? n = .00831 mol
T = 25°C or 298 K

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

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

V = .201 L

24.6 $P = ?$ atm $V = 602$ mL

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

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

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

$P = .339$ atm or $.338$ (Book)

24.8 $P = .998$ atm $V = 629$ mL $n = ?$

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

$PV = nRT$ $n = \frac{PV}{RT}$ $R = .0821 \frac{L \cdot atm}{mol \cdot K}$

$$\frac{.998\ atm}{} \left| \frac{629\ mL}{} \right| \frac{mol \cdot K}{.0821\ L \cdot atm} \left| \frac{308\ K}{} \right| \frac{1\ L}{1000\ mL}$$

$n = .0248$ mol

(25) 4.24 g N_2 58.2°C 2.04 atm

n V T P

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

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

$$4.24\text{ g} \left| \frac{1\text{ mol}}{28.00\text{ g}} \right| \frac{.0821\ L \cdot atm}{mol\ K} \left| \frac{331.2\ K}{} \right| \frac{}{2.04\ atm}$$

$V = 2.02$ L or 2.01 L (Book)

(26)

200.0 L $He + H_2$ P = 135 atm

V T = 24°C = 297 K

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

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

$n = 1110$ mol 2.00 g/mol H_2 = 2220 g H_2

4.00 g/mol He = 4440 g He

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

$V = 25.0\ L$ $R = .0821\ \frac{L \cdot atm}{mol \cdot K}$

$T = \frac{PV}{nR}$ molar mass N_2 $14.00 \times 2 = 28.00\ g/mol$

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

$T = 654\ K$ Book $654\ K$

(28) $P = ?$ $V = 125\ L$ $56.2\ kg\ O_2$

$T = 21°C = 294\ K$

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

$$\frac{56.2\ kg \mid 1000\ g \mid mol \mid .0821\ L \cdot atm \mid 294\ K \mid}{\mid 1\ kg \mid 32.00\ g \mid mol \cdot K \mid \mid 125\ L}$$

$P = 339\ atm$ Book $340.\ atm$

(29) Combined Gas Law will solve this problem!

However the ideal Gas law can be used.

$PV = nRT$

$\frac{P_1V_1}{n_1T_1} = R$ since R never changes

$\frac{P_2V_2}{n_2T_2} = R$

Thus

$$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$$

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

$\Rightarrow D$ $V_2 = ?$ $V_1 = 125\,mL$ He $T_1 = 100^\circ C = 373\,K$

$P_1 = .981\,atm$

$T_2 = 25^\circ C = 298\,K$ $P_2 = 1.15\,atm$

(Continued)

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

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

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

298 K	.981 atm	125 mL
373 K	1.15 atm	

$V_2 = 85.2$ mL

(30) use

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

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

$V_2 = ?$
$V_1 = 459$ mL
$T_1 = 27°C = 300$ K
$P_1 = 1.05$ atm
$T_2 = 15°C = 288$ K
$P_2 = .997$ atm
$n_1 = n_2$

288 K	1.05 atm	459 mL
300 K	.997 atm	

$V_2 = 464$ mL (Boole) 465 mL