Ch 6 Gases Exercises

27) a) $31.28\ in\ Hg \times \frac{760\ mm\ Hg}{29.92\ in\ Hg} = 809.0\ mm\ Hg$ b) $31.85\ in\ Hg \times \frac{1\ atm}{29.92\ in\ Hg} = 1.604\ atm$

29) a) $h = +7.0\ cm = 70.\ mm\ Hg$ $P_{gas} = 70. + 762.4 = 832\ mm\ Hg$

b) $h = -4.4\ cm = -44\ mm\ Hg$ $P_{gas} = 762.4 - 44 = 718\ mm\ Hg$

31) $P_1V_1 = P_2V_2$ $P_2 = \frac{P_1V_1}{V_2} = \frac{(735\ mm\ Hg)(5.6\ L)}{(9.4\ L)} = 440\ mm\ Hg$

33) $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $V_2 = \frac{V_1T_2}{T_1} = \frac{(48.3\ mL)(360\ K)}{(295\ K)} = 58.9\ mL$

35) $\frac{V_1}{n_1} = \frac{V_2}{n_2}$ $V_2 = \frac{V_1n_2}{n_1}$

$V_2 = \frac{(2.46\ L)(0.271\ mol)}{(0.158\ mol)} = 4.22\ L$

37) $PV = nRT$ $V = \frac{nRT}{P} = \frac{(0.118\ mol)\left(0.08206\ \frac{L \cdot atm}{mol \cdot K}\right)(305\ K)}{0.97\ atm} = 3.0\ L$ Same V (same n)

43) $V_1 = 11.8\ L$ $V_2 = 12.2\ L$ "guage"

$P_1 = 36.0 + 14.7 = 50.7\ psi$ $P_2 = ?$

$T_1 = 12.0°C \rightarrow 285\ K$ $T_2 = 65°C \rightarrow 338\ K$

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\frac{(50.7\ psi)(11.8\ L)}{(285\ K)} = \frac{P_2(12.2\ L)}{(338\ K)}$

$P_2 = 58.1\ psi$ exceeds Max $38.0 + 14.7 = 52.7\ psi$

51) $\frac{P_1}{T_1} = \frac{P_2}{T_2}$ $P_2 = \frac{(755\ mm\ Hg)(1428\ K)}{(298\ K)} = 3620\ mm\ Hg \rightarrow 4.76\ atm$

56) $N_2O = 2.85\ g/L$ @ $298\ K$ $P = mm\ Hg$? $2.85\ g \times \frac{1\ mol}{44.02\ g} = 0.06474\ mol$

$P = \frac{nRT}{V} = \frac{(0.06474\ mol)\left(62.36\ \frac{mm\ Hg \cdot L}{mol \cdot K}\right)(298\ K)}{1\ L} = 1200\ mm\ Hg$

63) $n = 1.20\ g \times 1\ mol/44.0\ g = 0.02727\ mol$ CO_2

$P = \frac{(0.02727\ mol)\left(62.36\ \frac{mm\ Hg \cdot L}{mol \cdot K}\right)(298\ K)}{0.7555\ L} = 671\ mm\ Hg$

$P_{Total} = 725 + 671 = 1396\ mm\ Hg$

70) $n_{O_2} = 2.0\ g \times 1\ mol/32.00\ g = 0.0625\ mol$ $n_{He} = 98.0\ g \times 1\ mol/4.003\ g = 24.48\ mol$

$X_{O_2} = \frac{0.0625\ mol}{0.0625 + 24.48} = 0.00255$ $P_{O_2} = 0.00255 \times 8.5\ atm = 0.022\ atm$

81) a) Yes, Same T = same KE b) No, $KE = \frac{1}{2}mv^2$ He - lighter moves faster

c) No, move slower due to larger mass Same P $F = ma$ $P = F/A$

d) He is smaller & faster → higher rate

89) A - higher molar mass because it has slower ave velocity
B - higher effusion rate → higher velocity

97) mass of gas = 143.289 g − 143.187 g = 0.102 g V = 255 mL P = 267 torr (= 267 mm Hg) T = 298 K

$$n = \frac{PV}{RT} = \frac{(267\ \text{mm Hg})(0.255\ \text{L})}{\left(62.36\ \frac{\text{mm Hg}\cdot\text{L}}{\text{mol}\cdot\text{K}}\right)(298\ \text{K})} = 0.00366\ \text{mol}$$

$$MM = \frac{0.102\ \text{g}}{0.00366\ \text{mol}} = 27.8\ \text{g/mol}$$

107) V = 0.855 L T = 298 K $P = 125\ \text{psi} \times \frac{1\ \text{atm}}{14.7\ \text{psi}} = 8.503\ \text{atm}$

$$n = \frac{PV}{RT} = \frac{(8.503\ \text{atm})(0.855\ \text{L})}{\left(0.0820\ \frac{\text{L atm}}{\text{mol}\cdot\text{K}}\right)(298\ \text{K})} = 0.297\ \text{mol}$$

$0.297\ \text{mol}_{\text{gas}} \times 28.8\ \text{g/mol}_{\text{air}} = 8.55\ \text{g air}$

" $\times 4.003\ \text{g/mol} = 1.19\ \text{g He}$

7.36 g diff

111) surface area $= 2(30.0\ \text{cm} \times 15.0\ \text{cm}) + 2(20.0\ \text{cm} \times 15.0\ \text{cm}) + 2(30.0\ \text{cm} \times 20.0\ \text{cm})$

$$= 2700\ \text{cm}^2 \times \frac{(1\ \text{in})^2}{(2.54\ \text{cm})^2} \times \frac{14.7\ \text{lb}}{1\ \text{in}^2} = 6150\ \text{lb}$$

Crush can