21) mercury is 13.6 times more dense than water, the column of water would be 13.6 times longer than that of the mercury to match the force exerted by the column of liquid standing on the surface

23) P vs $\frac{1}{V}$

the slope should be positive with y intercept of zero

$VP = k$ so $P = k\frac{1}{V}$

$y = mx + b$

24) $\underline{2}NH_{3(g)} \longrightarrow \underline{1}N_{2(g)} + \underline{3}H_{2(g)}$

2 mole $\longrightarrow$ 4 mole

$\cancel{P}V = n \cancel{R} \cancel{T}$

$\uparrow$ $\uparrow$

second scenario

$P\cancel{V} = n\cancel{RT}$

↑ ↑

moles doubles ⟶ pressure doubles

$P_{N_2} = \frac{1}{2} P_{NH_3}$ $P_{H_2} = \frac{3}{2} P_{NH_3}$

$P_{total} = P_{N_2} + P_{H_2}$

$\frac{1}{2} P_{NH_3} + \frac{3}{2} P_{NH_3} = 2P_{NH_3}$

3) a) $4.8\,atm \cdot \frac{760\,mmHg}{1\,atm} = 3.6 \times 10^3\,mmHg$

b) $3.6 \times 10^3\,mmHg \cdot \frac{1\,torr}{1\,mmHg} = 3.6 \times 10^3\,torr$

c) $4.8\,atm \cdot \frac{1.013 \times 10^5\,Pa}{1\,atm} = 4.9 \times 10^5\,Pa$

d) $4.8\,atm \cdot \frac{14.7\,psi}{1\,atm} = 71\,psi$

37) $6.5\,cm \cdot \frac{10\,mm}{1\,cm} = 65\,mmHg = 65\,torr$

$65\,torr \cdot \frac{1\,atm}{760\,torr} = 8.6 \times 10^{-2}\,atm$

$8.6 \times 10^{-2}\,atm \cdot \frac{1.013 \times 10^{5}\,Pa}{1\,atm} = 8.7 \times 10^{3}\,Pa$

39) a) $P_{Flask} < P_{atm}$

$P_{Flask} = 760. - 118 = 642\,torr$

$642\,torr \cdot \frac{1\,atm}{760\,torr} = 0.845\,atm$

$0.845\,atm \cdot \frac{1.013 \times 10^{5}\,Pa}{1\,atm} = 8.56 \times 10^{4}\,Pa$

b) $P_{Flask} > P_{atm}$

$P_{Flask} = 760. + 215 = 975\,torr$

$975\,torr \cdot \frac{1\,atm}{760\,torr} = 1.28\,atm$

$1.28\,atm \cdot \frac{1.013 \times 10^{5}\,Pa}{1\,atm} = 1.3 \times 10^{5}\,Pa$

c) $P_{Flask} = 635 - 118 = 517$ torr

$P_{Flask} = 635 - 215 = 850.$ torr

41) P_1 760 mmHg V_1 2.0 L

P_2 500. mmHg V_2 x

P ↓ V ↑

$$2.0\,L \; \frac{760\,mmHg}{500.\,mmHg} = 3.0\,L$$

the balloon will burst

43) $V \propto n$

V_1 11.2 L n_1 0.50 mol

V_2 20. L n_2 x

V ↑ n ↑

$$0.50\,mol \; \frac{20.\,L}{11.2\,L} = 0.89\,mol$$

45) a) $PV = nRT$

$$(5.00\,atm)(x) = (2.00\,mol)\left(0.0821\,\frac{atm \cdot L}{mol \cdot K}\right)(428\,K)$$

$x = 14.0\,L$

b) $PV = nRT$

$$(0.300\,atm)(2.00\,L) = (x)\left(0.0821\,\frac{atm \cdot L}{mol \cdot K}\right)(155\,K)$$

$x = 4.72 \times 10^{-2}$ mol

c) $PV = nRT$

$$(4.47\ \text{atm})(25.0\ \text{L}) = (2.01\ \text{mol})\left(0.0821\ \frac{\text{atm}\cdot\text{L}}{\text{mol}\cdot\text{K}}\right)x$$

$x = 678\ \text{K} = 405\ °\text{C}$

d) $PV = nRT$

$$(x)(2.25\ \text{L}) = (10.5\ \text{mol})\left(0.0821\ \frac{\text{atm}\cdot\text{L}}{\text{mol}\cdot\text{K}}\right)(348\ \text{K})$$

$x = 133\ \text{atm}$