IDEAL GAS LAW HW#1

TSOKOS p.181 #1-3, 5, 6

$1\ \frac{N}{m^2} = 1\ Pa$

$$P = \frac{F \cdot \cos\theta}{A}$$

$$P_1V_1 = P_2V_2 \quad \text{BOIL}$$

$$PV = nRT$$

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

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

$$PV = NKT$$

* All temps in KELVIN!

① $V_1 = 2.00\,L \quad T_1 = 293\,K \quad T_2 = 353\,K \quad V_2 = ?$

$$V_2 = \frac{V_1 \cdot T_2}{T_1} = \frac{(2.00\,L)(353\,K)}{(293\,K)} = \boxed{2.41\,L}$$

② $T_1 = 295\,K \quad P_1 = 12.0\ atm \quad T_2 = 393\,K$

$$P_2 = \frac{P_1 \cdot T_2}{T_1} = \frac{(12.0\ atm)(393\,K)}{(295\,K)} = \boxed{16.0\ atm}$$

③ $P_1 = 4.00\ atm \quad T_1 = 303\,K \quad V_1 = ?$

$P_2 = 3.00\ atm \quad T_2 = 313\,K \quad V_2 = .45\,L$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \qquad V_1 = \frac{P_2 \cdot V_2}{T_2} \cdot \frac{T_1}{P_1} = \frac{(3.00\ atm)(.45\,L)(303\,K)}{(313\,K)(4.00\ atm)}$$

$$\boxed{V_1 = 0.33\,L}$$

$12{,}000\,g\ He \times \frac{1\ mole}{4.003\,g} = 2997.8\ moles$

⑤ 12.0 kg He fills 5.00 L at T = 293 K P = ?

$PV = nRT \qquad P = \frac{nRT}{V} = \frac{(2997.8\ moles)(8.31\ \frac{J}{K \cdot mol})(293\ K)}{5.00\ L}$

$P = 1.46 \times 10^6\ Pa$ or $\times \frac{1\ atm}{1.013 \times 10^5\ Pa} =$

⑥ Mass of CO_2 needed to fill 12.0 L tank at T = 293 K and P = 4.00 atm = ?

(Δ to m^3; Δ to Pa)

$n = \frac{PV}{RT} = \frac{(4.00\ atm)(12.0\ L)}{(8.31\ \frac{J}{K \cdot mol})(293\ K)} = \frac{(4.052 \times 10^5\ \frac{kg \cdot m}{m^2 s^2})(12.0 \times 10^{-3}\ m^3)}{(8.31\ \frac{J(N \cdot m)}{K \cdot mol})(293\ K)}$

(change to Pa or $\frac{N}{m^2}$; change to m^3; $4.052 \times 10^5\ Pa$)

$n = 1997\ moles\ CO_2 \times \frac{44\ g}{mole} \times$ [illegible] $=$ [illegible] $87.9\ kg$