ch. 14
C & J ed. 5

(#15) $$N_{air} = \frac{PV}{k_B T} = \frac{(1.0\times10^{5}\,\frac{N}{m^2})(5.0\times10^{-4}\,m^3)}{(1.38\times10^{-23}\,\frac{J}{K})(310\,K)}$$

$$= 1.17\times10^{22}$$

$$N(O_2) = 0.21\,N_{air} = 2.45\times10^{21}$$

x ~~~~~~~~~~ x ~~~~~~~~~~ x

(#33) $V_1 = 680\,m^3$, $P_1 = 1.01\times10^{5}\,\frac{N}{m^2}$, $T_1 = 293.2\,K$

$V_2 = V_1$, $T_2 = 294.3\,K$

Assuming neon obeys ideal gas law: $PV = NkT$.

Hence, $N_1 = \frac{P_1V_1}{kT_1} = \frac{P_2V_2}{kT_2}$

For an ideal monatomic gas $U = N\left(\frac{3}{2}kT\right)$

Hence $U_2 - U_1 = \frac{3}{2}Nk(T_2 - T_1)$

Substituting $N = \frac{P_1V_1}{kT_1}$, we get

$$U_2 - U_1 = \frac{3}{2}\left(\frac{P_1V_1}{kT_1}\right)k(T_2 - T_1)$$

$$= \frac{3}{2}P_1V_1\frac{T_2 - T_1}{T_1} = \frac{3}{2}\frac{(1.01\times10^{5})(680)}{293.2}(1.1\,K)$$

$$= 3.865\times10^{5}\,J \simeq 3.9\times10^{5}\,J$$

x ~~~~~~~~~~ x ~~~~~~~~~~

(#54) $U = \frac{3}{2}NkT$, $PV = NkT$ $\rightarrow$ Eliminate T: $U = \frac{3}{2}PV$

$= (1.5)(6.2\times10^{5}\,\frac{N}{m^2})(.010\,m^3)$

$= 9300\,J$

$U = (\text{Power})(\text{time}) \Rightarrow \text{time} = \frac{U}{\text{Power}} = \frac{9300\,J}{(0.25\,HP)\frac{746\,W}{HP}}$

$= 50\,s.$