$\boxed{8\text{-}2}$ (a) $\langle E \rangle = \frac{3}{2}kT \Rightarrow 13.6\,eV = \frac{3}{2}(8.617\cdot 10^{-5}\,eV/k)\,T$

SOLVE FOR $T = \frac{2}{3}\frac{(13.6\,eV)\,K}{(8.617\cdot 10^{-5})\,eV} = 105{,}000\,K$

(b) $T = 10^7\,K$ $\langle E \rangle = \frac{3}{2}(8.617\cdot 10^{-5}\,eV/K)(10^7\,K) = \boxed{1.3\,keV}$

$\boxed{8\text{-}5}$ (a) $E_{TOT} = \int_0^\infty E\,n(E)\,dE = N\langle E \rangle = \frac{3}{2}NkT$

(N = number OF MOLECULES)

$Nk = nR$ WHERE n = number OF MOLES

$\Rightarrow E_{TOT} = \frac{3}{2}(1\,mol)\,R\,(273\,K) = \boxed{3.4\cdot 10^3\,J}$

$R = 8.31\,J/mol\cdot K$

(b) THE MOLAR MASS DID NOT ENTER THE CALCULATION, SO AS LONG AS YOU HAVE THE SAME NUMBER OF MOLES YOU GET THE SAME RESULT

$\boxed{8\text{-}8}$ (a) EQN (8-20) $f(V_x) = \left(\frac{m}{2\pi kT}\right)^{1/2} e^{-mv_x^2/2kT}$

$= \frac{1}{\sqrt{2\pi}}\left(\frac{m}{kT}\right)^{1/2} e^{-V_x^2/2(kT/m)} = \frac{1}{\sqrt{2\pi}}\frac{1}{V_0}e^{-V_x^2/2V_0^2}$

(b) FRACTION OF MOLECULES IN $\Delta V_x = f(V_x)\Delta V_x$

$\Delta V_x = .01\,V_0$

TOTAL NUMBER OF MOLECULES $= N f(V_x)\Delta V_x$

$\underline{V_x = 0}$ $= \frac{N}{\sqrt{2\pi}}\frac{1}{V_0}e^0(.01V_0) = N\cdot 3.9\cdot 10^{-3} = \boxed{2.3\cdot 10^{21}}$

(c) $\underline{V_x = V_0}$ $\frac{N}{\sqrt{2\pi}}\frac{1}{V_0}e^{-V_x^2/2V_0^2}(V_0\cdot .01) = \frac{.01\,N}{\sqrt{2\pi}}e^{-1/2} = \boxed{1.5\cdot 10^{21}}$

(d) $\underline{V_x = 2V_0}$ $\frac{N}{\sqrt{2\pi}}\frac{1}{V_0}e^{-4/2}(.01\,V_0) = \boxed{3.3\cdot 10^{20}}$

(e) $\underline{V_x = 8V_0}$ $\frac{N}{\sqrt{2\pi}}(.01)e^{-64/2} = \boxed{3.0\cdot 10^{7}}$

$\boxed{8-11}$ $n(E) = A\, g(E)\, e^{-E/kT}$

$$\frac{n_2}{n_1} = \frac{1}{10^6} = \frac{g(E_2)e^{-E_2/kT}}{g(E_1)e^{-E_1/kT}} = \frac{g(E_2)}{g(E_1)} e^{-(E_2-E_1)/kT}$$

ASSUME $\frac{g_2}{g_1} = 4 \Rightarrow \frac{1}{10^6} = 4\, e^{-(10.2\,eV)/kT}$

$\Rightarrow 4\,10^6 = e^{1.18\,10^5/T}$ $\quad \ln(4\,10^6) = 15.2 = 1.18\cdot 10^5/T$

$\Rightarrow T = \boxed{7.76\,10^3 K}$

$\boxed{8-17}$ FIND n_2/n_1, n_3/n_1, n_4/n_1 AT $T = 5800K$:

$$\frac{n_2}{n_1} = \frac{g_2}{g_1} e^{-(E_2-E_1)/kT}$$

FOR $n=1$, $l=0$ SO $g_1 = 2$ ($m_l = 0$, $m_s = \pm 1/2$)

FOR $n=2$, $l = 0$ OR 1 (8 STATES TOTAL) SO $g_2 = 8$

FOR $n=3$, $l = 2, 1$ OR 0 (18 STATES) SO $g_3 = 18$

FOR $n=4$, $l = 3, 2, 1$ or 0 SO $g_4 = 32$.

$E_2 = \frac{1}{4}E_1$, $E_3 = \frac{1}{9}E_1$, AND $E_4 = \frac{1}{16}E_1$, $E_1 = -13.6eV$

$$\Rightarrow \frac{n_2}{n_1} = \frac{8}{2} e^{+(\frac{1}{4}-1)13.6eV/(8.62\cdot 10^{-5}eV/K)5800K} = 5.5\cdot 10^{-9}$$

SIMILARLY, $\frac{n_3}{n_1} = \frac{g_3}{g_1} e^{+(\frac{1}{9}-1)|E_1|/kT} = 2.8\cdot 10^{-10}$

$$\frac{n_4}{n_1} = \frac{g_4}{g_1} e^{+(\frac{1}{16}-1)|E_1|/kT} = 1.3\cdot 10^{-10}$$