3. (1). $PV=nRT$.

$V=\frac{1\times 8.31\times(4+273)}{1.01\times10^6}=0.00132m^3$.

(2). $P_2V=n_2RT_2$

$n_2=\frac{\frac{9}{16}\times1.01\times10^6\times0.00132}{8.31\times(27+273)}=0.3mol$.

$\Delta n=0.2mol$.

4. (1). $P_0(V+nV')=P_nV$

$P_n=\frac{V+nV'}{V}P_0$

(2). $P_0(V-nV')=P_nV$

$P_n=\frac{V-nV'}{V}P_0$.

6. $\alpha=\frac{1}{V}(\frac{\partial V}{\partial T})=\frac{1}{V}\cdot\frac{\partial(\frac{nRT}{P})}{\partial T}=\frac{nR}{PV}=\frac{1}{T}$.

$\beta=\frac{1}{P}(\frac{\partial P}{\partial T})=\frac{1}{T}$

$k_T=-\frac{1}{V}(\frac{\partial V}{\partial P})=-\frac{1}{V}\cdot\frac{\partial(\frac{nRT}{P})}{\partial P}=\frac{1}{V}\cdot\frac{nRT}{P^2}=\frac{1}{P}$.

9. (1). $V=10^{-6}m^3$.

$P=\frac{1\cdot k\cdot T}{V}=\frac{1.38\times10^{-23}\times3}{10^{-6}}=4.14\times10^{-17}Pa$.

(2). $\bar{\varepsilon}=\frac{3}{2}kT=6.21\times10^{-23}J$

(3). $\sqrt{\overline{v^2}}=\sqrt{\frac{3kT}{m}}=\sqrt{\frac{3\times1.38\times10^{-23}\times3}{1.674\times10^{-27}}}=2.72\times10^2m/s$.