Key for Practice Problems

1. $q(V,T) = \sum_{\text{levels},j} g_j e^{-\beta \varepsilon_j}$

$q(V,T)$: molecular partition function as a function of Volume + Temp; $q(V,T)$ is a measure of the ability of a particle to escape the ground state

g_j : the degeneracy of the system

β : $1/k_B T$ (or a parameter related to T)

ε_j : energy of the j^{th} level

2. H−C≡C−H acetylene (linear)
   Total DOF = $3n = 3 \cdot 4 = 12$
   Trans DOF = 3
   Rot DOF = 2 (linear)
   Vib DOF = 7 ($3n-5$)

3. At the Boyle temperature, a gas acts ideally.
   So $\bar{V} = \bar{V}_{ideal}$ and $B_{2V} = 0$ (no deviation from ideality)
   Ans: e

4. $B_{2V} = \bar{V} - \bar{V}_{ideal}$ $\quad \bar{V}_{ideal} = \frac{RT}{P}$ @ same T+P, all gases have same $\bar{V}_{ideal}$

The smallest $\bar{V}$ will result in the smallest B_{2V}. (i.e. largest deviation) This is CO_2. [Makes sense because CO_2 is largest molecule + will likely have interactions].