

Due date: Tuesday, April 22

Deadline: Thursday, April 24

B means a problem in Blundell & Blundell's text; GT means a problem in Gould & Tobochnik.

1. B 21.1 B21.2 is also well worth a look, but is not assigned. B21.4 was worked out in class.
2. B22.2
3. B22.6, parts a and b up to eq. 22.97. (You do NOT need to do the evaluation at 1000K.) Assume the H atom has single bound state with energy R . (Not my choice of notation for a characteristic energy!) You should also assume that the mass of H is essentially the same as that of a proton. (You do not then need to discuss assumptions.) Note that the result of B22.5, which you need to use, is a 2-liner, once you fix the typo N_1 to the correct $N!$. You plug into $F = k_B T \ln Z_N$, use Stirling's approximation, use eq. 22.6, and combine the \ln 's.
This problem makes use of eq. 21.50 from problem 21.6 (as is stated in the problem). The solution to problem 21.6 starts with eq. 21.19, then ignores excited states and sets the zero of energy at $-R$ to get this result. I.e. the lowest energy state is at $-R$ and kinetic energy adds to that in the same way it added to 0 to get 21.19. Note that $e^{\beta R}$ is in the argument of \ln : $(Z_1^H/N_H)e^{\beta R}$ should be enclosed in big parentheses.
4. For the chemical reaction $2H_2 + O_2 \rightarrow 2H_2O$ (in gas phase), find the equilibrium constant K in terms of partial pressures (cf. eq. 22.81) and in terms of the change in molar Gibbs free energies at STP, as in eq. 22.86. According to Schroeder the molar Gibbs free energies (to form a mole of the molecule from elementary atoms in their purest state) for H_2 , O_2 and H_2O are 0, 0, and -228.57 kJ, respectively.
5. B23.1
6. B23.2 Note the typo in line 3: the function that should be maximized is $x^\alpha/(e^x - 1)$. The exponent of e is x , and α .