

## Homework C

PHY4523

Due: March 2, 2012

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1. (21.1)
2. (21.4)
3. (21.6)
4. (22.1) I did this in class. *Use Lagrange multiplier method. Read Text C.13. This a different route to derive the grand canonical ensemble.*
5. (22.5)\* *Typo in the problem. It should be  $Z_N = Z_1^N/N!$  Consider  $N$  as a variable.*
6. (22.6) only (a) and (b). *The single particle partition function in ideal gas is  $Z_1 = V/\lambda_{th}^3$ . You know this relation was derived based on the ground state energy is at zero. For an hydrogen atom the ground state energy is at  $R = -13.6$  eV so you need a factor  $e^{\beta R}$  to shift this amount of energy,  $Z_1 = V/\lambda_{th}^3 e^{\beta R}$ .*
7. (23.1) *Power radiated per unit area,  $P = \sigma T^4$ , Stefan-Boltzmann Law.*
8. (23.5) *From the central eq. of thermodynamics! For (d), using the result of (b) one can prove that keeping  $p$  constant results in constant  $T$ . So no matter how much heat you put,  $T$  will not change as far as  $p$  is kept constant!*
9. (23.3) *You may do (c) before (b).*
10. (23.6)