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Physics 404 **HOMEWORK ASSIGNMENT #9** **Fall 2014**

Due date: Thursday, Nov. 20 **Deadline:** Tuesday, Nov. 25

1. (10) 7.2 Model for hemoglobin attachment. Note that 7.1 is essentially the Langmuir problem done in class, so this problem is a generalization of that. You do not need to do the comparison, etc., in the last two lines of the problem. You may use $k_BT = 0.0267$ eV and $\lambda_T = 1.75 \times 10^{-11}$ m; these will be done explicitly in the solutions. Use results from the first problem to show $Z_{rot} \approx 74$

2. (10) 7.5 a-c Ionization of donors in a semiconductor. In b), take $Z_{int} = 2$.

3. (6) 7.22 Relativistic electrons: $\varepsilon \propto |\mathbf{p}|$. This is an easy corollary of the general result for the density of states derived in class.

4. (10) 7.23 b,c,f White dwarf star. Assume, from part a) that $U_{grav} = -(3/5)GM^2/R$.

   The answers to d and e are: $R \approx 7\times10^6$ m, $\rho \approx 1\times10^9$ kg/m^3, $\varepsilon_F \approx 2\times10^5$ eV, $T_F \approx 2\times10^9$ K

5. (7) 7.28 a,b,e D=2 Fermi gas. Part (b) is an easy corollary of the general result derived in class. For part (e), use the answer for part (d), which is $\mu = \ln[\exp(\varepsilon_F/k_BT) - 1]$

6. (7) 7.33a,b Semiconductors: gaps, chemical potential, holes, etc. This year 7.34 a-d is not assigned, but the solution will be provided.

   In 7.33 b [and in 7.34 b,c], use $\int_0^\infty \sqrt{x}\, e^{-x} dx = \sqrt{\pi}/2$