MIDTERM I EXAM – MAY 4, 2012

The following equations and constants may be helpful to you. You are not required to prove any formulae that are provided on this sheet, unless specifically requested to do so. The Y_{lm} functions and the *s, p, d* functions will be provided if you need them. **You may also fill the rest of this 8.5 x 11 page (this side only) with your own notes. Please turn in your equation sheet with your exam.**

$$E\left(\vec{k}\right) = \sum_{R} e^{i\vec{k}\cdot\vec{R}} \left\langle \vec{0} \middle| \hat{H} \middle| \vec{R} \right\rangle \qquad \Psi_{\vec{k}}\left(\vec{r} + \vec{T}\right) = e^{i\vec{k}\cdot\vec{T}} \Psi_{\vec{k}}\left(\vec{r}\right)$$

$$E\left(\vec{k}\right) = \frac{\hbar^2 k^2}{2m^*} \qquad D_{\updownarrow}(E) = \frac{V}{2\pi^2}\left(\frac{2m}{\hbar^2}\right)^{3/2} E^{1/2}$$

$$e^{i\theta} = \cos\theta + i\sin\theta$$

$$hc = 1240 \text{ eV nm} \qquad \hbar = \frac{h}{2\pi} = 1.05 \times 10^{-34} Js = 6.58 \times 10^{-16} \text{eVs}$$

$$k_B = 1.38 \times 10^{-23} \text{ J/K} = 8.6 \times 10^{-5} \text{ eV/K} \qquad e = 1.6 \times 10^{-19} \text{ C}$$

$$m_e = 9.1 \times 10^{-31} \text{ kg} = 9.1 \times 10^{-28} \text{ g} = 0.511 \text{ MeV/c}^2$$

$$N_A = 6.02 \times 10^{23} \text{ atom/mol}$$

$$\varepsilon_0 = 8.85 \times 10^{-12} \text{ F/m} \qquad \mu_B = \frac{e\hbar}{2m_e} = 8.9.27 \times 10^{-24} \text{ J/T}$$

$$v\left(\vec{k}\right) = \frac{1}{\hbar}\nabla_k E\left(\vec{k}\right) \qquad m^*\left(\vec{k}\right) = \frac{\hbar^2}{\nabla_k^2 E\left(\vec{k}\right)}$$

$$f_{FD} = \frac{1}{e^{(E-E_F)/k_B T} + 1}$$