MIDTERM I EXAM – MAY 3, 2013

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.

$$E\left(\vec{k}\right) = \sum_R e^{i\vec{k}\cdot\vec{R}} \left\langle \vec{0}\middle|\hat{H}\middle|\vec{R}\right\rangle \qquad E\left(\vec{k}\right) = \frac{\hbar^2 k^2}{2m^*}$$

$$D_{\updownarrow}(E) = \frac{V}{2\pi^2}\left(\frac{2m}{\hbar^2}\right)^{3/2} E^{1/2} \qquad dS = D(E)dE$$

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

$$hc = 1240 \text{ eV nm} \qquad \hbar = \frac{h}{2\pi} = 1.05\times10^{-34}\,Js = 6.58\times10^{-16}\,\text{eVs}$$

$$k_B = 1.38\times10^{-23}\,\text{J/K} = 8.6\times10^{-5}\,\text{eV/K} \qquad e = 1.6\times10^{-19}\,\text{C}$$

$$m_e = 9.1\times10^{-31}\,\text{kg} = 9.1\times10^{-28}\,\text{g} = 0.511\ \text{MeV/c}^2$$

$$N_A = 6.02\times10^{23}\ \text{atom/mol}$$

$$\varepsilon_0 = 8.85\times10^{-12}\,\text{F/m} \qquad \mu_B = \frac{e\hbar}{2m_e} = 8.9.27\times10^{-24}\,\text{J/T}$$

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

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

$$\vec{g}_1 = 2\pi\frac{\vec{t}_2\times\vec{t}_3}{\vec{t}_1\cdot\left(\vec{t}_2\times\vec{t}_3\right)} \qquad \vec{g}_2 = 2\pi\frac{\vec{t}_3\times\vec{t}_1}{\vec{t}_1\cdot\left(\vec{t}_2\times\vec{t}_3\right)} \qquad \vec{g}_3 = 2\pi\frac{\vec{t}_1\times\vec{t}_2}{\vec{t}_1\cdot\left(\vec{t}_2\times\vec{t}_3\right)}$$