

FINAL EXAM – JUNE 13, 2014

The following equations and constants may be helpful to you. You may fill the double-sided page with handwritten notes.

$$E(\vec{k}) = \sum_{\vec{R}} e^{i\vec{k}\cdot\vec{R}} \langle \vec{0} | \hat{H} | \vec{R} \rangle \quad E(\vec{k}) = \frac{\hbar^2 k^2}{2m^*} \quad v(\vec{k}) = \frac{1}{\hbar} \nabla_{\vec{k}} E(\vec{k})$$

$$D_{\downarrow}(E) = \frac{V}{2\pi^2} \left(\frac{2m}{\hbar^2} \right)^{3/2} E^{1/2} \quad dS = D(E) dE \quad m^*(\vec{k}) = \frac{\hbar^2}{\nabla_{\vec{k}}^2 E(\vec{k})}$$

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

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

$$hc = 1240 \text{ eVnm}$$

$$k_B = 1.38 \times 10^{-23} \text{ J/K} = 8.6 \times 10^{-5} \text{ eV/K}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

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

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

$$\mu_B = \frac{e\hbar}{2m_e} = 9.27 \times 10^{-24} \text{ J/T} = 5.8 \times 10^{-5} \text{ eV/T}$$

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$$

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

$$f_{MB}(E, T) = A e^{-E/k_B T}$$

$$f_{BE}(E, T) = \frac{1}{e^{E/k_B T} + 1}$$

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

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

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

$$\sigma = \frac{ne^2\tau}{m^*}$$

$$R_H = \frac{1}{nq}$$

$$\omega_p = \sqrt{\frac{ne^2}{\epsilon_0 m^*}}$$

$$\Delta V = S\Delta T$$

$$\vec{B} = \mu_0 (\vec{H} + \vec{M})$$

$$\vec{D} = \epsilon_0 (\vec{E} + \vec{P})$$

$$\chi = \frac{M}{H} \approx \frac{\mu_0 M}{B}$$

$$C_V = \frac{\pi^2}{3} D_{\downarrow}(E_F) k_B^2 T$$

$$\frac{K_{el}}{\sigma T} = L = 2.45 \times 10^{-8} \text{ W}\Omega / \text{K}^2$$

$$n_c = n - i\kappa$$

$$\epsilon = \epsilon_1 - i\epsilon_2$$

$$n^2 = \epsilon$$

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Periodic Table of the Elements © www.elementsdatabase.com

1 H																	2 He				
3 Li	4 Be	■ hydrogen ■ alkali metals ■ alkali earth metals ■ transition metals										■ poor metals ■ nonmetals ■ noble gases ■ rare earth metals				5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr				
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe				
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn				
87 Fr	88 Ra	89 Ac	104 Unq	105 Unp	106 Unh	107 Uns	108 Uno	109 Une	110 Unn												

58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr