

ENGR-1600-01 Quiz 8 - 100 pts Prof. Lewis Name: _____

Some useful equations are given below:

$$n\lambda = 2d \sin(\theta) \quad d_{hkl} = \frac{a}{\sqrt{(h^2 + k^2 + l^2)}} \quad N_A = 6.023 \cdot 10^{23} \quad \rho = \frac{nA}{V_C N_A}$$

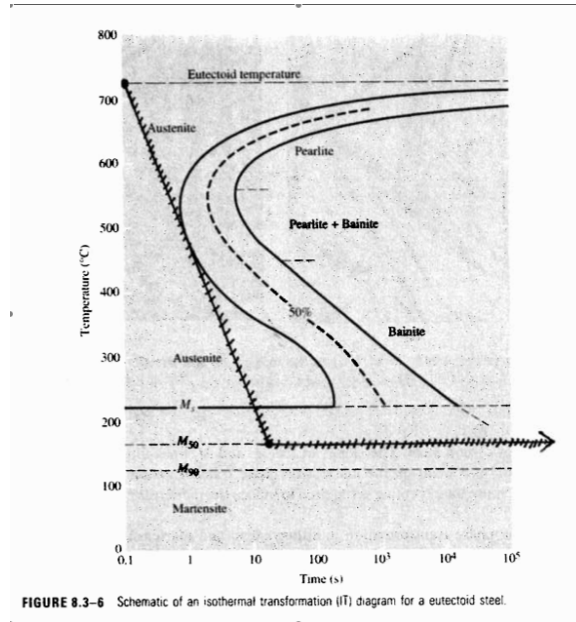
$$\sigma = \frac{F}{A_0} \quad \sigma = E\epsilon \quad \tau_{crss} = \sigma_y \cos \theta \cos \phi \quad \nu = -\frac{\epsilon_x}{\epsilon_z} = -\frac{\epsilon_y}{\epsilon_z}$$

$$SC : a = 2R \quad FCC : a = \frac{4R}{\sqrt{2}} \quad BCC : a = \frac{4R}{\sqrt{3}} \quad \mathbf{a} \cdot \mathbf{b} = |a||b| \cos \theta$$

$$\%CW = \frac{A_0 - A_f}{A_0} \cdot 100 \quad K_{IC} = Y \sigma_c \sqrt{\pi a} \quad \epsilon = \frac{l_i - l_0}{l_0} = \frac{\Delta l}{l_0}$$

$$N = N_0 \exp(-Q_v/(kT)) \quad P+F=C+2$$

1. (25) For the TTT diagram and heat treatment shown. What constituent phase morphologies will be in the final microstructure?



2. (25) There are three steps to precipitation hardening: solution annealing, quenching, and aging. Explain each of these steps using one sentence per step.

A. Solution annealing

B. Quenching

C. Aging

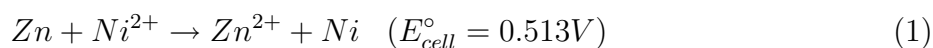
Table 16.1 The Standard emf Series

	<i>Electrode Reaction</i>	<i>Standard Electrode Potential, V^0 (V)</i>
	$\text{Au}^{3+} + 3e^- \longrightarrow \text{Au}$	+1.420
	$\text{O}_2 + 4\text{H}^+ + 4e^- \longrightarrow 2\text{H}_2\text{O}$	+1.229
	$\text{Pt}^{2+} + 2e^- \longrightarrow \text{Pt}$	~+1.2
	$\text{Ag}^+ + e^- \longrightarrow \text{Ag}$	+0.800
	$\text{Fe}^{3+} + e^- \longrightarrow \text{Fe}^{2+}$	+0.771
	$\text{O}_2 + 2\text{H}_2\text{O} + 4e^- \longrightarrow 4(\text{OH}^-)$	+0.401
	$\text{Cu}^{2+} + 2e^- \longrightarrow \text{Cu}$	+0.340
	$2\text{H}^+ + 2e^- \longrightarrow \text{H}_2$	0.000
	$\text{Pb}^{2+} + 2e^- \longrightarrow \text{Pb}$	-0.126
	$\text{Sn}^{2+} + 2e^- \longrightarrow \text{Sn}$	-0.136
	$\text{Ni}^{2+} + 2e^- \longrightarrow \text{Ni}$	-0.250
	$\text{Co}^{2+} + 2e^- \longrightarrow \text{Co}$	-0.277
	$\text{Cd}^{2+} + 2e^- \longrightarrow \text{Cd}$	-0.403
	$\text{Fe}^{2+} + 2e^- \longrightarrow \text{Fe}$	-0.440
	$\text{Cr}^{3+} + 3e^- \longrightarrow \text{Cr}$	-0.744
	$\text{Zn}^{2+} + 2e^- \longrightarrow \text{Zn}$	-0.763
	$\text{Al}^{3+} + 3e^- \longrightarrow \text{Al}$	-1.662
	$\text{Mg}^{2+} + 2e^- \longrightarrow \text{Mg}$	-2.363
	$\text{Na}^+ + e^- \longrightarrow \text{Na}$	-2.714
	$\text{K}^+ + e^- \longrightarrow \text{K}$	-2.924

↑
Increasingly inert
(cathodic)

↓
Increasingly active
(anodic)

3. (50) For the reaction identified below, answer the following questions:



A. Is the reaction spontaneous?

B. What are the half cell reactions and standard cell potentials?

C. Which is the oxidation reaction?

D. In which direction will the electrons flow? Anode to cathode, or, cathode to anode?
(Circle one.)