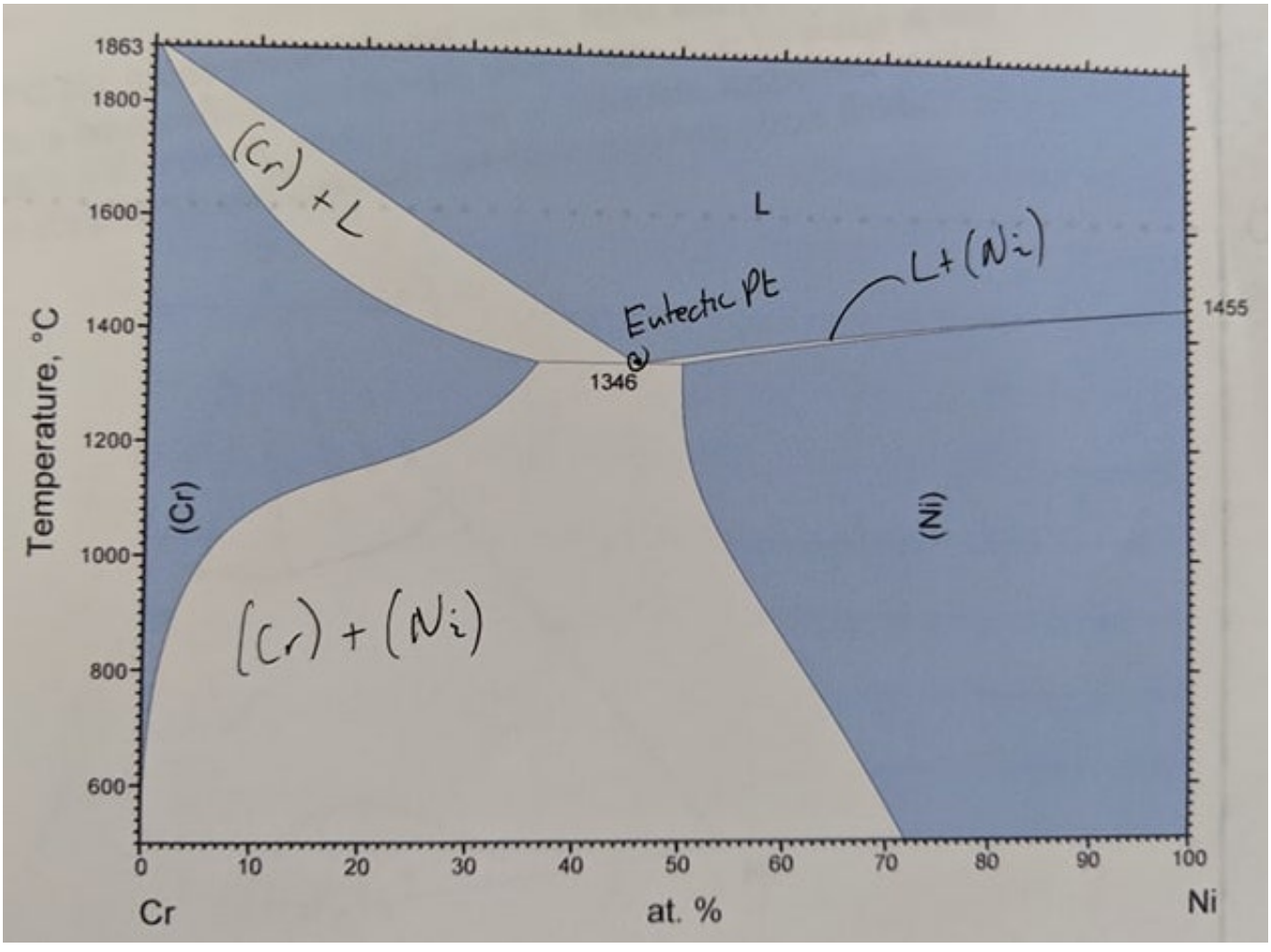
Midterm 1 Rubric

MSE 103 - Phase Transformations and Kinetics

March 17, 2019

Problem 1a. 10 points

2 pts per 2-phase region
4 pts for eutectic point



Problem 1b. 10 points

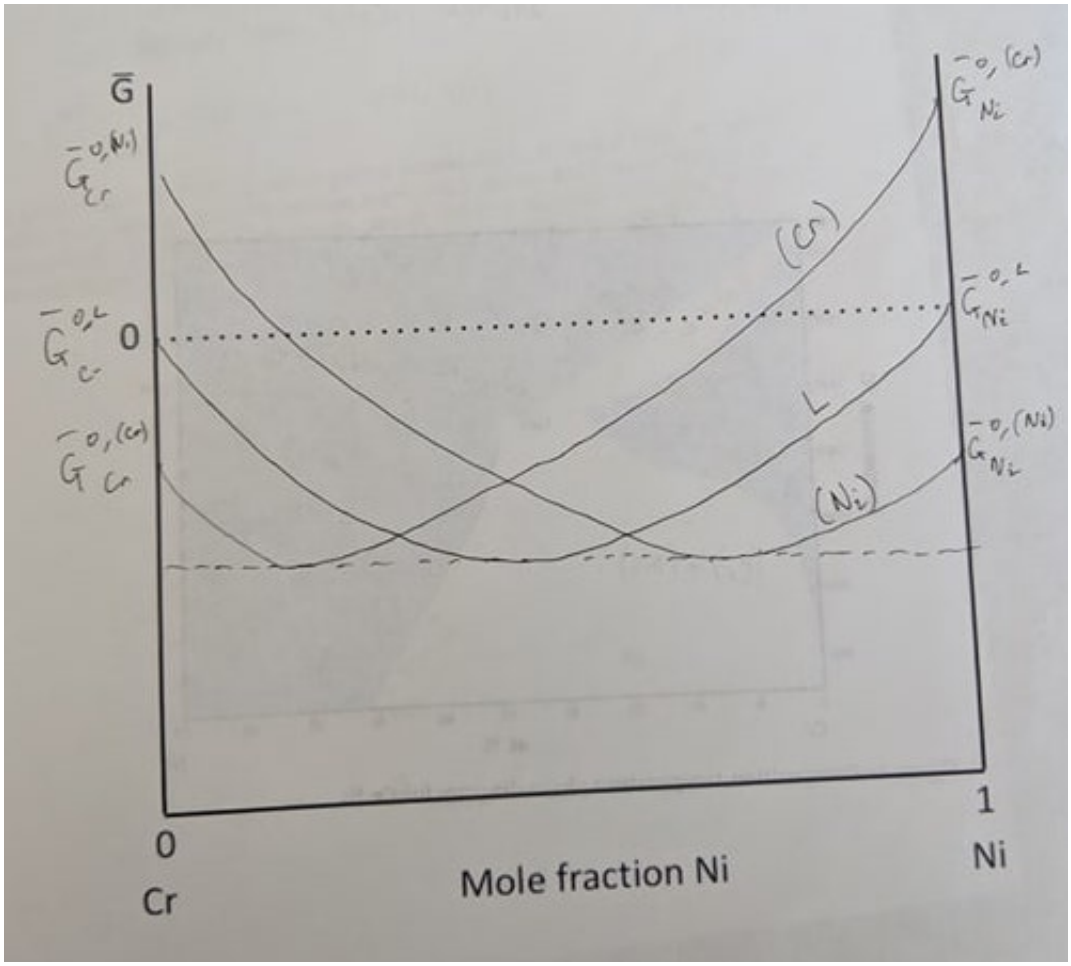
3 points for lowest temperature
2 points for measuring compositions
2 points for lever rule
3 points for correct answer

Lowest Temperature: 1346°C
Phase fraction:

$$F^l = \frac{0.40 - 0.35}{0.46 - 0.35} = 0.45$$

Problem 1c. 15 points

i)
6 points for labelling pure energies
2 points for reference states
2 points for reasonable relative positions
ii)
5 points for common tangent



Problem 1d. 15 points

5 points for equating chemical potentials
5 points for correct equations for μ
5 points for correct answer

$$\begin{aligned}
\mu_{Cr}^{(Cr)} &= \mu_{Cr}^{(Ni)} \\
G_{Cr}^{0,(Cr)} + RTln(0.01) &= G_{Cr}^{0,(Ni)} + RTln(0.6) + 14.5\frac{kJ}{mol}(1-0.6)^2 \\
\Delta G_{Cr}^{(Ni)\rightarrow(Cr)} &= 38.8\frac{kJ}{mol}
\end{aligned}$$

Problem 1e. 15 points

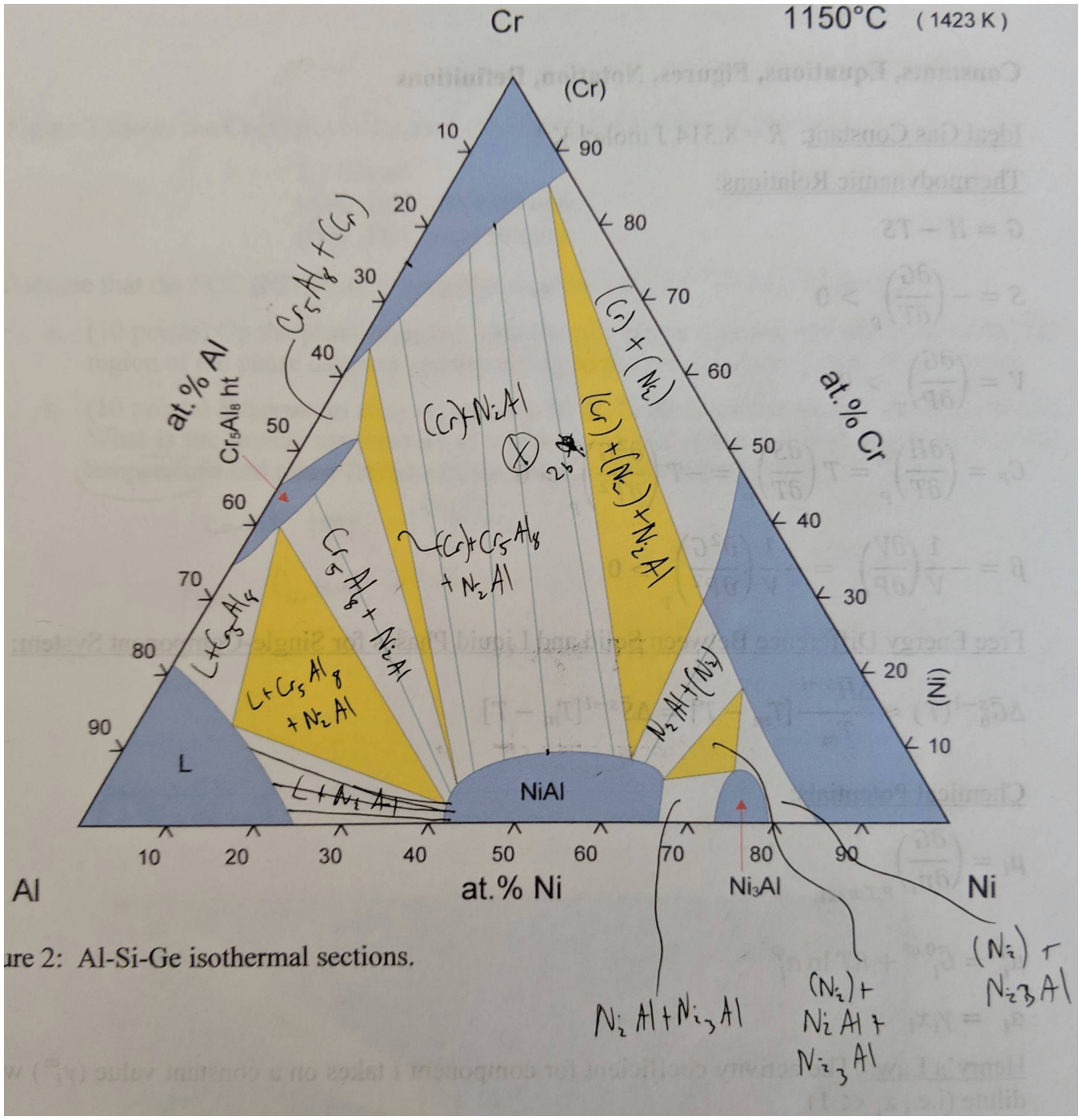
7 points for correct inequality
8 points for explanation

$$\Omega^{BCC} > \Omega^{FCC}$$

because Cr is fairly soluble in (Ni) at low temperatures while Ni is barely soluble in (Cr) at low temperatures

Problem 2a. 10 points

10 points for all correct
9 points for at least 12 correct
8 points for at least 11 correct
7 points for at least 9 correct
6 points for at least 8 correct
5 points for at least 6 correct
4 points for at least 5 correct
3 points for at least 3 correct
2 points for at least 2 correct
1 points for at least 1 correct



ure 2: Al-Si-Ge isothermal sections.

Problem 2b. 10 points

3 points for each composition
2 points for correct use of lever rule
1 point for each correct phase fraction

$$C_{Cr} = (0.80Cr, 0.08Ni, 0.12Al)$$
$$C_{NiAl} = (0.09Cr, 0.49Ni, 0.42Al)$$

$$F^{NiAl} = \frac{1.38inch}{3.12inch} = \frac{3.5cm}{7.9cm} = 0.44$$
$$F^{(Cr)} = 1 - F^{NiAl} = 0.56$$

Problem 2c. 15 points

3 points for each single phase region
3 points for each two phase region