Problem Set # 1 Grading Criteria CHAPTERS 2 & 3

Graded: 2.17(a), 3.8, 3.27

2.17 (a) The main differences between the various forms of **primary** bonding are:

lonic--there is electrostatic attraction between oppositely charged ions.

Covalent--there is electron sharing between two adjacent atoms such that each atom assumes a stable electron configuration.

Metallic--the positively charged ion cores are shielded from one another, and also "glued" together by the sea of valence electrons.

1 point each for identification of the three primary bonding types (3 points)

1 point each for appropriate keywords or phrases (3 points):

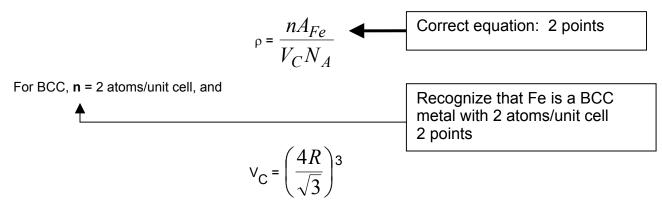
Ionic: electrostatic, ions, or electron transfer

Covalent: electron sharing

Metallic: free electrons, sea of electrons, or de-localized electrons

Maximum possible: 6

3.8 This problem calls for a computation of the density of iron. According to Equation (3.5)



Thus,

$$\rho = \frac{(\text{2 atoms/unit cell})(55.9 \text{ g/mol})}{\left[(4)(0.124 \text{ x } 10^{-7} \text{ cm})^3 / \sqrt{3} \right]^3 / (\text{unit cell})(6.023 \text{ x } 10^{23} \text{ atoms/mol})}$$

= 7.90 g/cm^3 (The value given inside the front cover is 7.87 g/cm^3 .) Correct substitution in equation and final answer: 2 points

Maximum possible: 6

3.27 (a) We are asked for the indices of the two directions sketched in the figure. For direction **1**, the projection on the **x**-axis is zero (since it lies in the **y**-**z** plane), while projections on the **y**- and **z**-axes are **b**/2 and **c**, respectively. This is an [012] direction as indicated in the summary below

	<u>x</u>	У	<u>z</u>	
Projections	0a	b/2	С	
Projections in terms of a , b ,				Correct components:
and c	0	1/2	1	1
Reduction to integers	0	1	2	
Enclosure		[012]		Reduction to integers and enclosure: 1
Direction 2 is [112] as summariz	ed below.			Total possible: 2 points each (part a)
	<u>X</u>	У	<u>z</u>	
Projections	a/2	b/2	-C	
Projections in terms of a , b ,				
and c	1/2	1/2	-1	
Reduction to integers	1	1	-2	
Enclosure		[112]		

(b) This part of the problem calls for the indices of the two planes which are drawn in the sketch. Plane **1** is an (020) plane. The determination of its indices is summarized below.

	<u>X</u>	У	<u>Z</u>
Intercepts	∞ a	b/2	∞ c
Intercepts in terms of a, b,			
and c	∞	1/2	∞
Reciprocals of intercepts	0	2	0
Enclosure		(020)	

Plane $\mathbf{2}$ is a ($2\overline{2}$ 1) plane, as summarized below.

Correct intercepts: 1

Reciprocals and reduction to integers: 1

Total possible: 2

points each (part b)

	<u>X</u>	У	<u>z</u>
Intercepts	a/2	-b/2	С
Intercepts in terms of a , b ,			
and c	1/2	-1/2	1
Reciprocals of intercepts	2	-2	1
Enclosure		(22 1)	

Maximum possible: 8

Grand total: 20 points