Distributed: Oct. 11, 2021
Due: Oct. 15, 2021 (Fri)

Bio-integrated Materials Science (Online Lectures)

Crystal systems, Point coordinates,
Crystallographic directions

Lecture 3_Homework

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Crystal Systems: Due Oct. 15, 2021 (Fri)

3.2 If the atomic radius of aluminum is 0.143 nm, calculate the volume of its unit cell in cubic meters.

3.3 Show for the body-centered cubic crystal structure that the unit cell edge length a and the atomic radius R are related through $a = 4R/\sqrt{3}$.

3.7 Iron has a BCC crystal structure, an atomic radius of 0.124 nm, and an atomic weight of 55.85 g/mol. Compute and compare its theoretical density with the experimental value found inside the front cover of this book.

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3.24 On the basis of ionic charge and ionic radii given in Table 3.4, predict crystal structures for the following materials:

(a) CsI **(c)** KI

(b) NiO **(d)** NiS

Table 3.4 Ionic Radii for Several Cations and Anions for a Coordination Number of 6

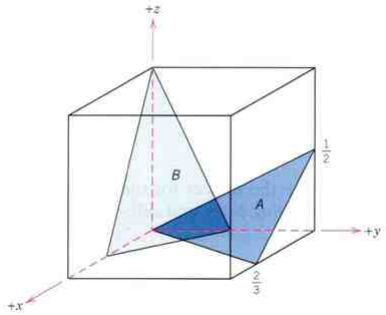
Cation	Ionic Radius (nm)	Anion	Ionic Radius (nm)
Al^{3+}	0.053	Br^-	0.196
Ba^{2+}	0.136	Cl^-	0.181
Ca^{2+}	0.100	F^-	0.133
Cs^+	0.170	I^-	0.220
Fe^{2+}	0.077	O^{2-}	0.140
Fe^{3+}	0.069	S^{2-}	0.184
K^+	0.138		
Mg^{2+}	0.072		
Mn^{2+}	0.067		
Na^+	0.102		
Ni^{2+}	0.069		
Si^{4+}	0.040		
Ti^{4+}	0.061		

3.52 Within a cubic unit cell, sketch the following directions:

(c) $[01\bar{2}]$ **(g)** $[1\bar{2}3]$

(d) $[\bar{1}33]$ **(h)** $[\bar{1}03]$

3.64 Determine the Miller indices for the planes shown in the following unit cell:



3.72 Determine the indices for the planes shown in the following hexagonal unit cells: