Gen Chem with Doc M

Wednesday 12/2/15

Today: 11.4, 11.6, 11.7

Thursday: Monika review session @ 7pm Eppley 110

Friday: 11.8, 11.9

Sunday: Review session!

Monday: Review in class for CK6

Tuesday: Bonus review session!

Wednesday: Last CK (#6)
Doors open @ 7:15 am

Types of Solids

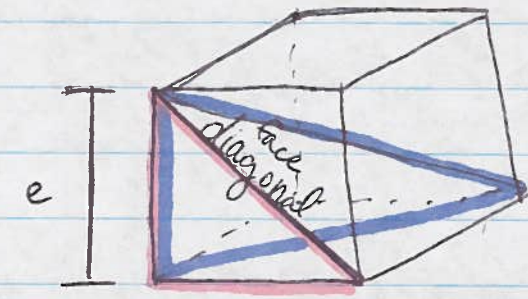
ionic
cations + anions
lattice energy

metals
"metallic forces"
function like cation in "sea of e^-"

covalent molecular
(s, l, g)
solids: common for H-bonding
LDF $\propto$ MM
* large molar mass

network covalent

Cube basics



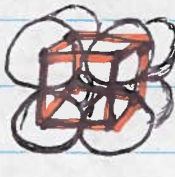
$V_{cube} = e^3$

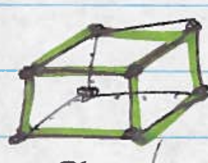
face diagonal $= \sqrt{2}\, e$ $\left(e^2 + e^2 = (fd)^2 \Rightarrow 2e^2 = fd^2 \Rightarrow \sqrt{2}\, e = fd \right)$

"through-body" diagonal $= \sqrt{3} e$ $\left(e^2 + (\sqrt{2} e)^2 = h^2 \Rightarrow 3e^2 = h^2 \Rightarrow \sqrt{3}\, e = h \right)$

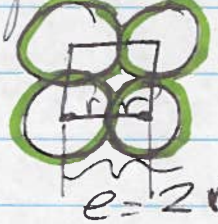
Unit Cell

<u>Simple cubic</u>





front view



8 atoms, each with 1/8 atom inside

1 atom / unit cell

Polonium simple cube

Polonium

AM = 208.982

$e = 334$ pm

$r = e/2 = 334/2 = 167$ pm

density? Mass one Po atom $= \frac{208.982 g}{mol} \left| \frac{mol}{6.022 \times 10^{23} atoms} \right. \times 1 atom$

$= 3.47 \times 10^{-22}$ g

$e = 334 \text{ pm} \left| \frac{10^{-12} m}{1 pm} \right| \frac{1 cm}{10^{-2} m} = 3.34 \times 10^{-8}$ cm

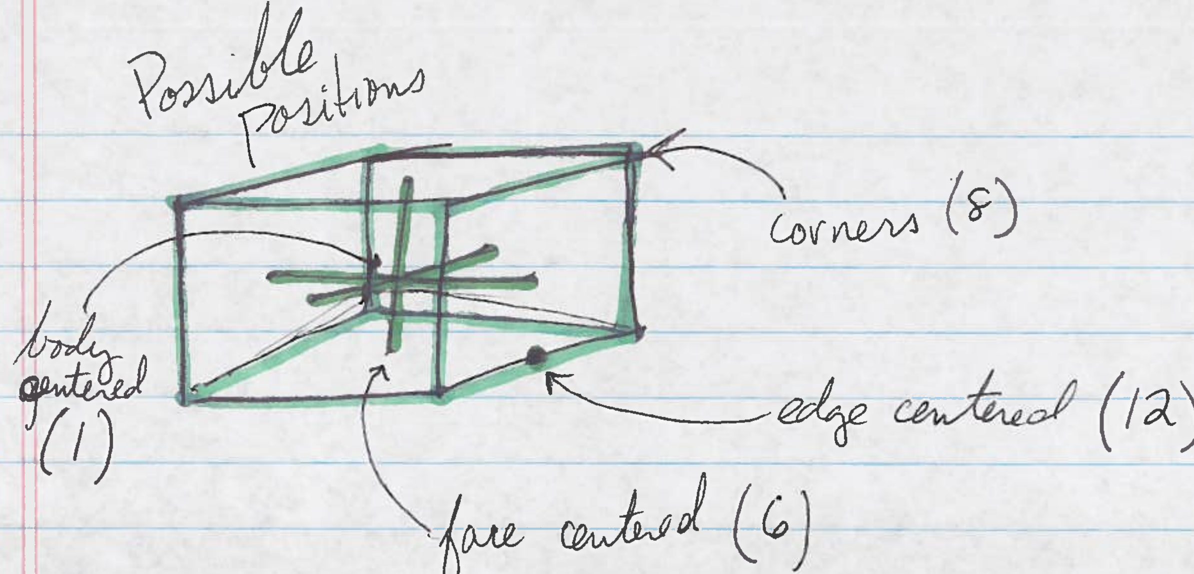
$V = e^3 = (3.34 \times 10^{-8} cm)^3 = 3.73 \times 10^{-23} cm^3$

$d = \frac{m}{V} = \frac{3.47 \times 10^{-22} g}{3.73 \times 10^{-23} cm^3} = 9.31 g/cm^3$

If we know the cell, you can go from

$r \leftrightarrow e \leftrightarrow d$

CsCl has simple cube of Cl^- with Cs^+ inside



Body Centered Unit cell

Fe atoms at the corners $8 \times 1/8 = 1$ Fe

Fe atom at the body center 1 Fe

2 Fe atoms per unit cell

Contact is at body diagonal

$\sqrt{3}\, e = 4r$

Unique to body centered cubic

Fe has a density of $7.874\ g/cm^3$

bcc

calculate r_{Fe}

$d = \frac{m}{V} \rightarrow V = \frac{m}{d} \rightarrow e \rightarrow r$

$$V = \frac{55.845\,g}{\cancel{mol}} \left| \frac{2\,Fe\ atm}{6.022\times10^{23}\ atoms} \right| \frac{1\,cm^3}{7.874\,g} = 2.36\times10^{-23}\,cm^3$$

$$V = e^3 \Rightarrow e = \sqrt[3]{V} = 2.87\times10^{-8}\,cm$$

$$4r = \sqrt{3}\,e \Rightarrow r = \frac{\sqrt{3}\,e}{4} =$$

Folder Activity Chapter 11 Number 2 2 December 2015

Printed Name: Monika Satkauskas Chm 203 Student number: TA

1. Identify the type of bonding that characterizes each of these substances.

KBr	(Ionic)	Covalent-Molecular	Network covalent	Metallic
C(graphite)	Ionic	Covalent-Molecular	(Network covalent)	Metallic
SiC, similar structure to diamond	Ionic	Covalent-Molecular	(Network covalent)	Metallic
CO_2	Ionic	(Covalent-Molecular)	Network covalent	Metallic

2. How many atoms are contained within a unit cell at each of these positions?

the corners $8 \times 1/8 =$ 1 atom

the body-center 1 atom

the edge-centers $12 \times 1/4 =$ 3 atoms

the face-centers $6 \times 1/2 =$ 3 atoms

X the tetrahedral holes of a fcc lattice

X the octahedral holes of a fcc lattice

X 3. Lead crystallizes in a fcc unit cell with an edge length of 495 pm. What is the atomic radius of lead in pm?	X 4. What is the density of lead using the information from Problem 3?

5. Cesium chloride crystallizes with chloride ions in a simple cube unit cell. The cesium ions occupy the body-centered positions. How many of each ion are present within each unit cell? Does this match the predicted formula for cesium chloride?

Cs = body center, so only 1 atom

Cl = corners, so $1/8 \times 8 = 1$ atom

Formula: CsCl

1:1, so it matches

X 6. Sphalerite is a salt of zinc cations and sulfide anions. Sphalerite crystallizes with sulfides forming a fcc sublattice and the zinc ions filling half of the tetrahedral holes. How many of each ion are present within each unit cell? What is the predicted formula for this salt?