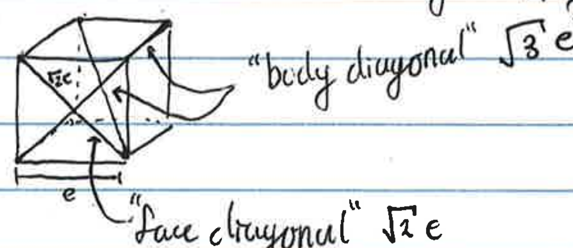
Today: chapter 11
tomorrow: Experiment 12
Friday: last day for new content for the year!
Monday: Review day for test
Wednesday (4/25): Exam

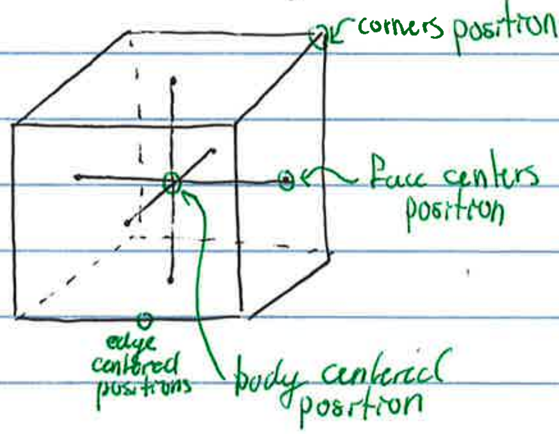
Review:

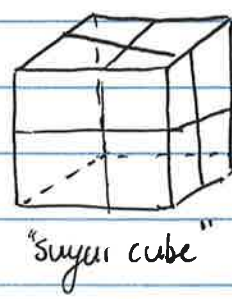
$^{222}_{86}Rn \rightarrow 3\,^{4}_{2}\alpha + 2\,^{0}_{-1}\beta + \,^{210}_{82}Pb$

* balance top number first, then bottom

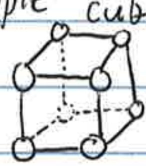
lattices: Unit cells as they apply to metal atoms

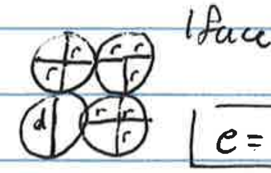






Simple cube unit cell:





$e = 2r$ (simple cube unit cell specific)

has metal atoms on all 8 corners

number of metal atoms inside each unit cell $= 8 \times \frac{1}{8} = 1$

$V_{unit\ cell} = e^3$ (always true)

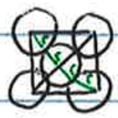
formula and unit cell → $density = \frac{m_{unit\ cell}}{V_{unit\ cell}}$

atomic mass ↙

$$d_{metal} = \frac{m}{V} = \frac{AM_{metal} / 6.02 \times 10^{23} \times 1 \text{ metal atom}}{V_{unit\ cell}}$$ (for simple cube unit)

$d_{metal} \rightarrow V_{unit\ cell} \rightarrow e \rightarrow r_{metal}$ (always true)
(knowing metal and unit cell type)

face centered unit cell: Will have highest density



e

$\boxed{\sqrt{2}e = 4r}$ specific to face centered unit cell

atoms at all 8 corners + atoms at face centered positions

$(8 \times \frac{1}{8} \text{ atom}) + (\frac{1}{2} \times 6 \text{ atom})$

$1 + 3 = 4$ atoms / unit cell

$V = e^3$

$$density_{unit\ cell} = \frac{m_{4 \text{ atoms in unit cell}}}{V_{unit\ cell}} = \frac{AM_{metal} \times 4 / 6.02 \times 10^{23}}{V_{unit\ cell}}$$

body centered unit cell:

- metal atoms at all 8 corners + one atom at body centered position

$(8 \times \frac{1}{8}) + (1)$

$1 + 1 = 2$ atoms / unit cell

- Direct metal-metal contact is along the body diagonal

$\boxed{\sqrt{3}e = 4r}$ specific to body centered unit cell

$V = e^3$

$$density = \frac{m_{2 \text{ atoms}}}{V_{unit\ cell}} = \frac{AM_{metal} \times 2 / 6.02 \times 10^{23}}{V_{unit\ cell}}$$

from metals and unit cells ⇒ ions and unit cells

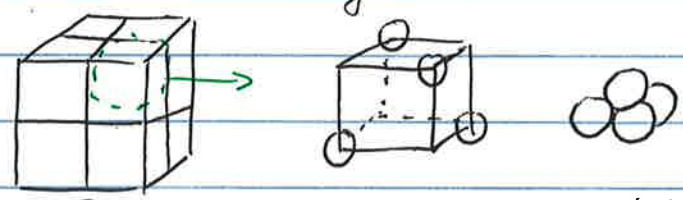
big ion (usually anion) go where metals went

small ions (usually cation) fit into the "holes" between atoms

In f.c.c, 12 holes along edge-centered positions, (octahedral holes (6 sided holes))

each hole is $\frac{1}{4}$ inside the unit cell, and

1 at the body center $((12 \times \frac{1}{4}) + 1) = 4$ holes / unit cell



tetrahedral holes are tiny and there is 8 / unit cell

fcc is most important ionic style

4 big ions / unit cell

small ions have a choice: 4 octahedral holes (1:1 small to big ratio)

8 tetrahedral holes (2:1 small to big ratio)