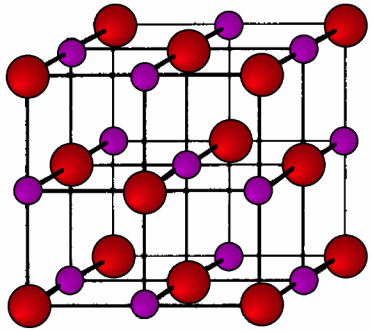
Chem H2A

Final Review

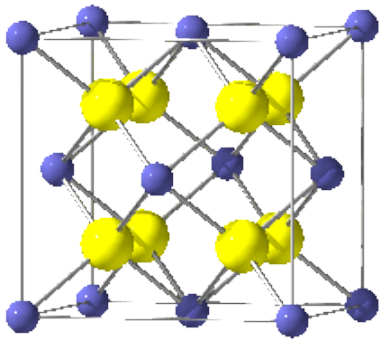
Solids

A



- For NaCl (rock salt structure A) and CaF_2 (fluorite structure B), please determine the number of each type of atom, empirical formula and the number of formula units per unit cell
- The density of CaF_2 is 3.18 g/cm^3. Find the lattice parameter of CaF_2 in angstroms.

B



- The radii of Na^+ and Cl^- are 95 pm and 181 pm, respectively. What is the packing efficiency (V_{atoms}/V_{cell}) of this cell? How much volume (in m^3) of the unit cell is UNOCCUPIED?

Helium Shortage

The mole fraction of Helium in the earth's atmosphere is $\chi_{He} = 5.263*10^{-6}$. What is the partial pressure of He?

In a cubic meter of air at room temperature (298K), how many moles of He are present?

The escape velocity of the earth at an altitude of 500 km is 10.75 km/s. What is v_{rms} of He assuming the temperature is 1500K in the exosphere? So how does He escape?

Electron Backscatter Diffraction (EBSD)

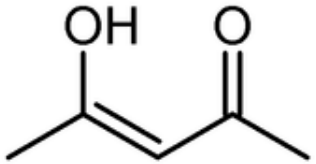
The XL-30 SEM at UCI can do EBSD. Electrons at 40keV are fired at a sample. What is the wavelength of these electrons?

XL-30 SEM @ UCI

Some of the scattered electrons fulfill the Bragg condition. If you could somehow do EBSD on Polonium (radioactive, volatile, primitive cubic cell, r = 168 pm), at what angle would you expect to see the n = 109 constructive interference diffraction peak.

Can you see the n = 110 peak?

Hydrogen Bonding



Consider the enol form of acetylacetone. This molecule can hydrogen bond *intra*molecularly. Please draw the structure with the hydrogen bond. Also determine which oxygen is the hydrogen donor and which is the hydrogen acceptor.

How would you expect the frequency of an IR OH vibration to change with hydrogen bonding?

A Blast From The Past

aka things you should know

- Unit Conversions
- Photoelectric Effect
- PIAB
- H atom (Rydberg)
- DeBroglie Wavelength
- Quantum numbers - n, l, m_l, m_s
- Term symbols
- Lewis Dot Structures & Resonance
- VSEPR - formulas, bond angles, dipoles, hybridization
- Isomers
- IR spectroscopy - normal modes, IR active?, frequency, force constant, reduced mass
- Raman - Stokes vs. Antistokes
- MO Diagrams - homo/hetero nuclear, IP, bond order, para/diamagnetic