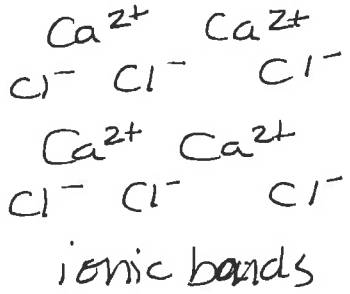
Chem 130, Eppley

KEY

Homework Introduction to Solids

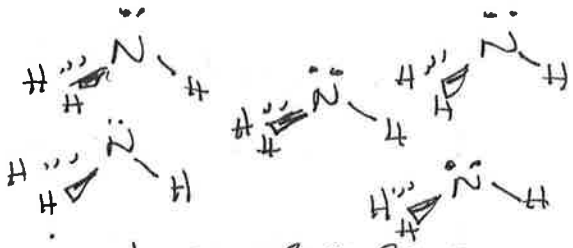
1. For the following solid substances, draw a representation of the atomic/molecular level interactions in a solid form of it! Say what type of forces are holding it together!

$CaCl_2$ ionic



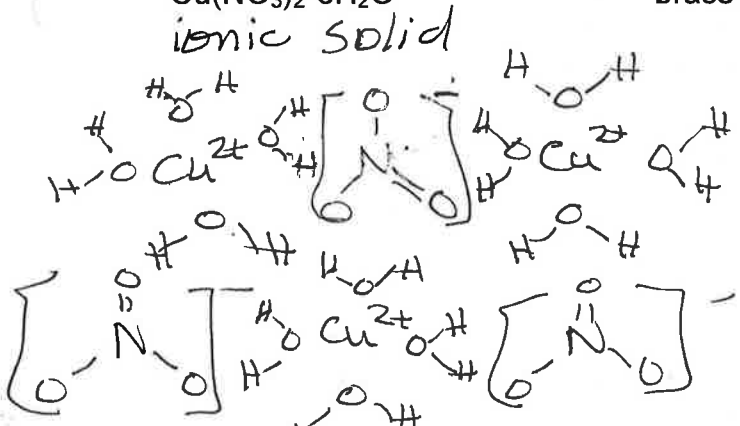
ionic bonds

NH_3 molecular solid



intermolecular forces

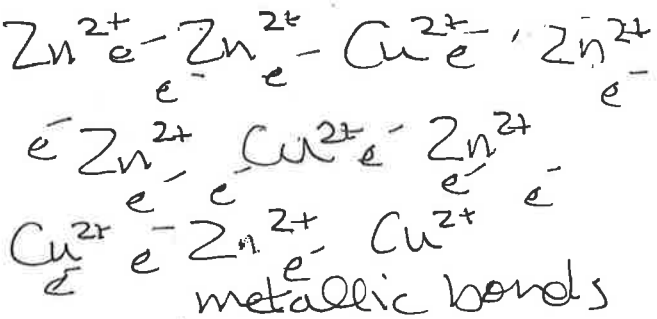
$Cu(NO_3)_2 \cdot 6H_2O$ ionic solid



ionic bonds

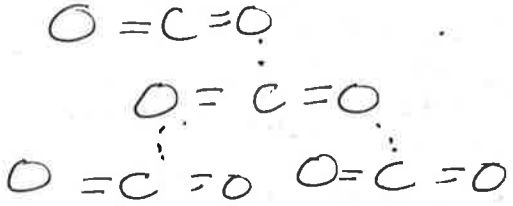
brass (use the internet to figure out what's in it first!)

Zn Cu metallic



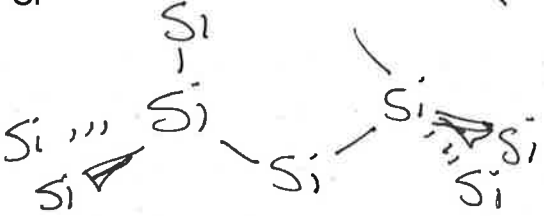
metallic bonds

CO_2 molecular



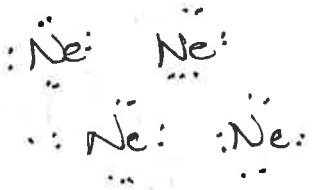
weak intermolecular forces

Si covalent network



covalent bonds

Ne atomic



weak interatomic forces (dispersion forces)

Chem 130, Eppley
Spring 2015

2. Below is a representation of the smallest repeating unit of an oxide of silicon that is NOT the normal one observed for quartz.

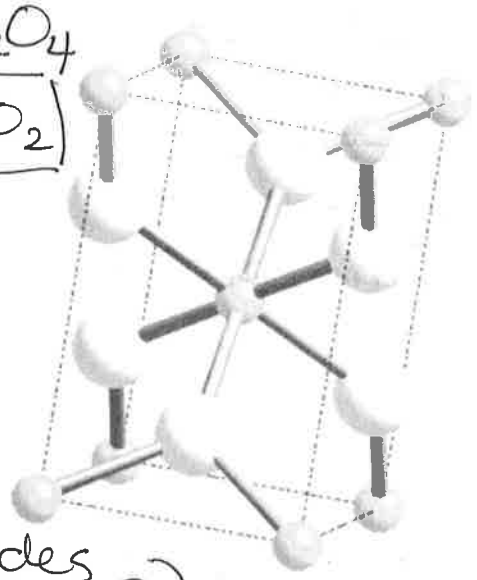
a. Based on this structure, if the oxides are represented by the large spheres and the silicon by the small spheres, what is the formula for this compound? Show your work by clearly by indicating why you counted particular atoms the way you did? (5 pt)

Si 8 corners × (1/8) = 1
1 full = 1

O 4 faces × (1/2) = 2
2 full = 2/4

Si_2O_4

$\boxed{SiO_2}$



b. *Approximately* what type of lattice do the Si make by themselves? (3 pt)
body centered cubic

c. Briefly, after examining the unit cell closely, why is that lattice not *exactly* the one you indicated? (2 pt) unit cell is not cubic (sides are not equal)

d. What is the coordination number of the oxides? (2 pt) 3

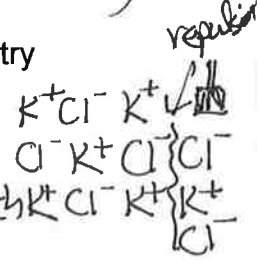
e. What is the coordination number of the Si on the corners? (2 pt) 6

f. This structure is exactly like one of the others you encountered in Lab 7. Which one? (2 pt) rutile (TiO_2)

g. What category of solid does this compound form (i.e. what kind of forces hold it together? (2 pt) covalent network (covalent bonds)

3. Explain why K metal is a good conductor of electricity and is malleable (don't try at home!), but KCl is a poor conductor in the solid state and brittle. Use diagrams of the bonding models to help your explanations.

Potassium is a good conductor because the sea of electrons are delocalized and thus can move through the solid and conduct electricity. It is malleable b/c when a layer of cations are displaced, the sea of e⁻ moves with them and the bonds are not broken (even though it is deformed).



For the ionic solid the charges are stationary in the solid (and e⁻ are localized on ions), so it is an insulator. When a layer of ions is displaced, ionic bonds are broken and repulsions introduced, so the solid flies apart!