Session #8: Homework Problems

Problem #1

Two lasers generate radiation of (1) 9.5 μm and (2) 0.1 μm respectively.

(a) For each of the radiations, determine the photon energy (in eV).

(b) Will either of the two radiations be able to break (dissociate) the Si–H bond in SiH4? Given: E_{Si-Si} = 180 kJ/mole

E_{H-H} = 435 kJ/mole

Problem #2

The equilibrium distance in diatomic LiF is 1.52Å. Assuming ionic bonding between the two atoms, calculate the energy required to separate them: $Li^+ - F^- \rightarrow Li^+ + F^-$. (Without additional information your answer should be correct to within 10%.)

Problem #3

Covalent bonds are directional and "saturated"; ionic bonds are "unsaturated" and "non-directional".

(a) Explain why.

(b) What are general consequences of the differences in the bonding characteristics?

Problem #4

Write the chemical formulas for the *ionic* compound formed by interaction of the elements:

(1) calcium and fluorine
(2) aluminum and chlorine
(3) potassium and sulfur
(4) iron and oxygen
(5) zinc and chlorine
(6) cesium and bromine
(7) strontium and selenium
(8) copper and chlorine
(9) cobalt and fluorine
(10) titanium and oxygen

Problem #5

Attempt to account for the following properties of an ionic material:

(a) transparent

(b) insulators (electric)

(c) conductors (electric)

[No more than a sketch (if you wish) and four lines of text/answer.]

Problem #6

Hydrogen and selenium react with each other to form a compound.
(a) What is the chemical formula of the compound?
(b) At room temperature, do you expect this compound to be a solid, a liquid or a gas? Substantiate your answer.

Problem #7

(a) Determine the differences in relative electronegativity (Δx in eV) for the systems H–F and C–F given the following data:

Bond Energy	kJ/mole
H_2	436
F_2	172
C-C	335
H-F	565
C-H	410

(b) Taking $X_H = 2.1$, determine the relative electronegativities (in eV) for C and F.

Problem #8

For NaF the repulsive (Born) exponent, n, is 8.7. Making use of data given in your Periodic Table, attempt to calculate the crystal energy (ΔE_{cryst}). (What assumption do you have to make to calculate ΔE_{cryst}?)

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