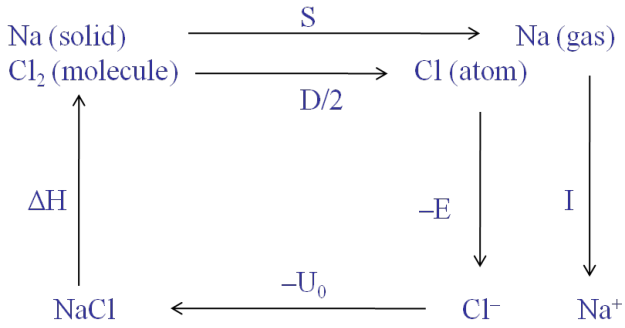
Solid state physics 2018 Problem Set #3. Due Mar. 28

1. Explain the terms: a. Ionization energy, b. Lattice energy, c. Cohesive energy, d. Electron affinity.
2. The formation of NaCl crystal may be visualized as occurring in different steps, each of which results in energy absorption or evolution. The Born-Haber cycle represents such steps:



i. Start with solid sodium and chlorine molecule. Solid sodium is vaporized by subjecting the sublimation energy (S). Chlorine molecule is dissociated into 2 Cl atoms by supplying dissociation energy (D). D/2 is per Cl atom.

ii. Na gaseous atom is ionized into Na+ by applying the ionization energy (I) and this electron is added to Cl atom. As Cl atom has the electron affinity (E), an energy E is given out.

iii. The two ions ($Na^+ + Cl^-$) are arranged into the lattice and hence the lattice energy (U_0) is released.

iv. We again reach at the starting point by supplying an energy (Δ H) known as heat of dissociation.

We represent the expenditure of energy as positive and the release of energy as negative. Express U_0 in terms of other quantities. How about the cohesive energy?

3. Kittel, Chap. 3. Problem 2
4. Kittel, Chap. 3. Problem 3
5. Kittel, Chap. 3. Problem 5
6. Kittel, Chap. 3. Problem 7