

Eðlisfræði þéttfnis I

Dæmablað 1

Skilafrestur 4. September 2018 kl. 15:00

1. Cohesive energy NaCl (10)

(a) What is the cohesive energy with respect to separated ions for crystalline NaCl ? Give the approximate value and a derivation using a very simple model. Lattice constant $a = 5.6 \text{ \AA}$.

(b) What experimental quantities must be added to or subtracted from the above to give you the cohesive energy with respect to separated sodium metal and chlorine gas ? Omit small ($< 10 \%$) effects.

2. Ionic crystal KF (10)

In a single molecule of KF, the equilibrium internuclear separation is $r_0 = 2.67 \text{ \AA}$ and the cohesive energy ($-E_i$) relative to separated ions is 0.50 eV/molecule smaller than the Coulomb attractive energy, because of overlap repulsion. Given that the electron affinity of fluorine is 4.07 eV/electron and that the first ionization potential of potassium is 4.34 volts , show that the energy necessary to separate the molecule into neutral atoms is $-0.945E_i$.

3. Madelung's Rule (15)

Use Madelung's rule to deduce the atomic shell filling configuration of the element tungsten (symbol W) which has atomic number 74. Element 118 has recently been discovered, and is expected to be a noble gas, i.e., is in group VIII. (No real chemistry tests have been performed on the element yet, as the nucleus decays very quickly.) Assuming that Madelung's rule continues to hold, what should the atomic number be for the next noble gas after this one ?