FR Practice #3 (2016 #1, shortened, 6 points)

3. A student investigates the enthalpy of solution, ΔH_{soln}, for two alkali metal halides, LiCl and NaCl. To explain why ΔH_{soln} for NaCl is different than that for LiCl, the student investigates factors that affect ΔH_{soln} and finds that ionic radius and lattice enthalpy (which can be defined as the ΔH associated with the separation of a solid crystal into gaseous ions) contribute to the process. The student consults references and collects the data shown in the table below.

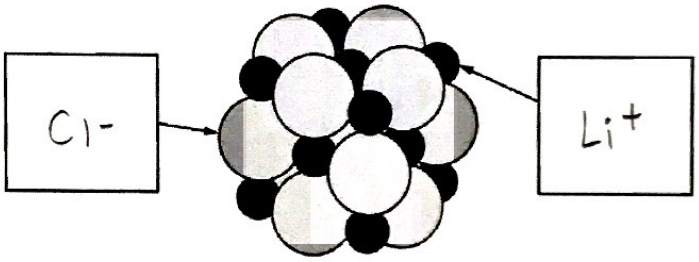
Ion	Ionic Radius (pm)
Li^+	76
Na^+	102

a. Write the complete electron configuration for the Na^+ ion in the ground state. (1 point)

b. Using principles of atomic structure, explain why the Na^+ ion is larger than the Li^+ ion. (1 point)

c. Which salt, LiCl or NaCl, has the greater lattice enthalpy? Justify your answer. (1 point)

d. Below is a representation of a portion of a crystal of LiCl. Identify the ions in the representation by writing the appropriate formulas (Li^+ or Cl^-) in the boxes below. (1 point)



e. The lattice enthalpy of LiCl is positive, indicating that it takes energy to break the ions apart in LiCl. However, the dissolution of LiCl in water is an exothermic process. Identify all particle-particle interactions that contribute significantly to the dissolution process being exothermic. For each interaction, include the particles that interact and the specific type of intermolecular force between those particles. (2 points)

a) $1s^2 2s^2 2p^6$

b) The valence e^- in Na^+ are in a higher principal energy level than those of Li^+, + thus are farther from the nucleus.

c) LiCl. Since Li^+ is smaller than Na^+, the Coulombic attractions between ions in LiCl are stronger than in NaCl, resulting in a greater lattice energy.

e) $Li^+ - H_2O$, $Cl^- - H_2O$ both are ion-dipole interactions.