1. A student investigates the enthalpy of solution, $\Delta H_{\text{soln}}$, for two alkali metal halides, LiCl and NaCl. In addition to the salts, the student has access to a calorimeter, a balance with a precision of ±0.1 g, and a thermometer with a precision of ±0.1°C.

(a) To measure $\Delta H_{\text{soln}}$ for LiCl, the student adds 100.0 g of water initially at 15.0°C to a calorimeter and adds 10.0 g of LiCl(s), stirring to dissolve. After the LiCl dissolves completely, the maximum temperature reached by the solution is 35.6°C.

(i) Calculate the magnitude of the heat absorbed by the solution during the dissolution process, assuming that the specific heat capacity of the solution is 4.18 J/(g·°C). Include units with your answer.

(ii) Determine the value of $\Delta H_{\text{soln}}$ for LiCl in kJ/mol$_{\text{rxn}}$.

To explain why $\Delta H_{\text{soln}}$ for NaCl is different than that for LiCl, the student investigates factors that affect $\Delta H_{\text{soln}}$ and finds that ionic radius and lattice enthalpy (which can be defined as the $\Delta H$ 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.

<table>
<thead>
<tr>
<th>Ion</th>
<th>Ionic Radius (pm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li$^+$</td>
<td>76</td>
</tr>
<tr>
<td>Na$^+$</td>
<td>102</td>
</tr>
</tbody>
</table>
(b) Write the complete electron configuration for the Na\(^+\) ion in the ground state.

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

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

(e) 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.

(f) 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.