LATTICE ENTHALPIES

1. Define the terms

   a) lattice dissociation enthalpy;

   b) lattice formation enthalpy.

2. NaCl, NaBr and MgO all have the same crystal structure.

   a) Explain why the lattice dissociation enthalpy of NaBr is a bit less than that of NaCl.

   b) Explain why the lattice dissociation enthalpy of MgO is about 5 times greater than that of NaCl.

3. a) Define the term standard atomisation enthalpy.

   b) The standard atomisation enthalpy of bromine is +112 kJ mol^{-1}, and for sodium is +107 kJ mol^{-1}. Write equations for the reactions that these figures relate to.

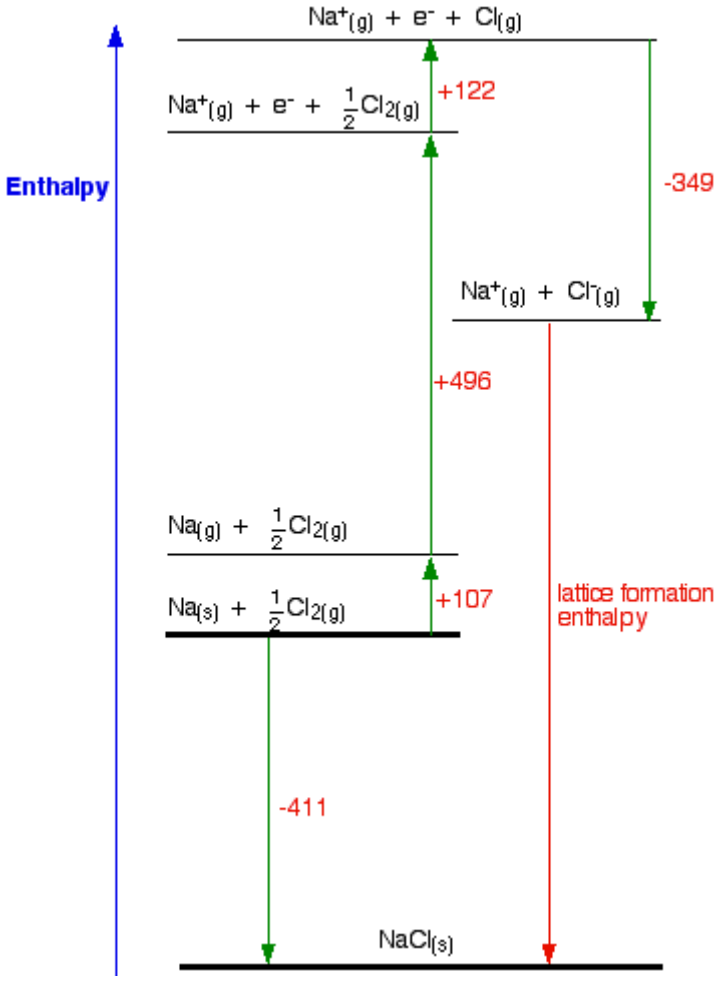
4. The Born-Haber cycle for the formation of sodium chloride is:

   a) The +107 figure is the atomisation enthalpy of sodium. Explain what all the other figures represent.

   b) Use the figures on the diagram to calculate the lattice formation enthalpy of NaCl.

   c) Draw the equivalent diagram which would enable you to calculate the lattice formation enthalpy of magnesium chloride, $MgCl_2$. Write the names of the enthalpy changes against each arrow rather than using actual values.

   (Sorry, but this is as far as I can go with this on Chemguide. You will need to practise it further from another source.)



5. Lattice enthalpies can be calculated from figures obtained experimentally using Born-Haber cycles. They can also be calculated theoretically.

   The table (using figures for lattice energies from www.webelements.com) gives experimental and theoretical values for the silver halides.

   (The values are listed as lattice dissociation energies. Don't worry about the difference between lattice energy and lattice enthalpy. All I am asking you to do is to compare the values, and you can do that OK without worrying about the exact difference between the two terms.)

	experimental (kJ mol^{-1})	theoretical (kJ mol^{-1})
AgF	+967	+953
AgCl	+915	+864
AgBr	+904	+830
AgI	+889	+808

   a) For AgF, the experimental and theoretical values are very close. What does that show?

   b) For AgI, there is a much greater difference between the two values. What does that suggest?

   c) Why do you think the difference between the two values increases as you go from AgF to AgI?

6. Two of the biggest enthalpy changes during a Born-Haber cycle are the energy needed to ionise the metal, and the energy released when the positive and negative ions come together to make the lattice - the lattice formation enthalpy.

   In terms of these energy changes, explain why magnesium forms a chloride with the formula $MgCl_2$ and not MgCl or $MgCl_3$. (I am not expecting you to quote any numbers here - you can discuss it perfectly well in general terms.)