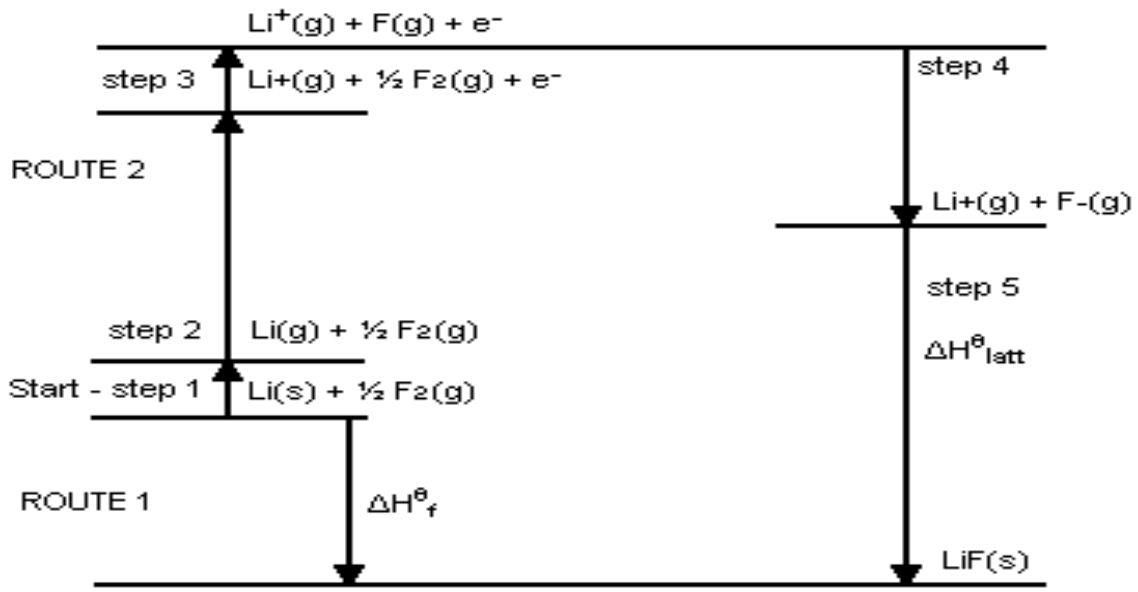
Lattice enthalpy : The when of an compound is formed from its in their states, under of and .

Lattice enthalpy is always .

The more exothermic the lattice enthalpy the the ionic bonds between the oppositely charged ions.

Lattice enthalpy is theoretical, gases do not really combine we work out lattice enthalpy by using a Born-Haber cycle.

<u>Born-Haber cycle for Lithium Fluoride</u>



Route one =

Step one: Enthalpy change of of lithium.

The enthalpy change when of gaseous atoms is formed from the in its .

Step two: enthalpy of lithium.

The required to one from atom in of atoms. To produce one of .

The . The energy required to remove one electrons from each . In one mole of to form one mole of .

Step three: Enthalpy change of of fluorine.

Step four: of fluorine.

The enthalpy change when of gain of .

The first is always .

The second is always . Why?

Step five

Route 1: The of of lithium fluoride.

The when of a is from its constituent in their .

Calculating lattice enthalpy

Calculate the lattice enthalpy of LiF given the following data:

Enthalpy change	Value in $Kjmol^{-1}$
Enthalpy change of atomization of lithium	+159.4
Enthalpy change of atomization of fluorine	+79
1st Ionisation of lithium	+520
1st electron affinity of fluorine	-320
Enthalpy of formation of lithium fluoride	-606

Construct a Born Haber cycle and calculate the enthalpy of formation of MgO given the following data:

Enthalpy change	Value in $Kjmol^{-1}$
Enthalpy change of atomization of Magnesium	+148
Enthalpy change of atomization of oxygen	+249.5
1st Ionisation energy of Magnesium	+738
2nd Ionisation energy of Magnesium	+1451
1st electron affinity of oxygen	-141
2nd electron affinity of oxygen	+798
Lattice enthalpy of magnesium oxide	-3791

Why do you think the value of lattice enthalpy is so much more negative for MgO compared to LiF?

Trends in lattice enthalpy

Size of the ions: If the ions are and have the same , the ions will form a lattice e.g. CaO and BaO. The size of the barium ion means the centre of the and cation are not as close. Therefore, there is a force of attraction.

Charge of the ions: As the charge on the ion . The lattice enthalpy becomes more e.g. Na_2O and MgO , because the force of attraction between the and the is .

Polarisation of ions: Polarisation is the of the electron cloud in a molecule or ion by a nearby charge. In ionic compounds metal ions the electrons of a ion. This means there is significant character in the compound leading to a force of attraction and lattice enthalpy numerically .

Combination of the factors

It is hard to accurately asses what factors are the most important when discussing lattice enthalpy. It is generally considered that on the ion has the greatest effect.

Another type of Born-Haber cycle can be used to explain the
of substances in .

Enthalpy change of solution: The enthalpy change when of
an dissolves in water.

Enthalpy change of hydration: The enthalpy change when one mole of a
ion is completely by water under standard
conditions of .

The of a substance can be calculated by using the
value and the
(the energy required to break up one mole of an ionic compound). The difference
between these two values gives us the . In some
courses the reverse of the is used. Make sure to check which term
you should be using.

The enthalpy of hydration is energy released due to the force
between and the positive and negative ion of the substance
e.g.

Enthalpy of hydration becomes more when there is a charge on the ion and when the ion is . Therefore, enthalpy of hydration becomes less down .

Calculating enthalpy of solution using a Born-Haber style cycle.

Using the data below construct an enthalpy of solution cycle for NaCl

Enthalpy	Value in $Kjmol^{-1}$
Lattice enthalpy of NaCl	-780
Enthalpy of hydration of Na	-418
Enthalpy of Hydration of Cl	-338

The enthalpy change of solution is yet NaCl will readily in water. This must mean that there is another factor when looking at the solubility of a substance. This is known as .