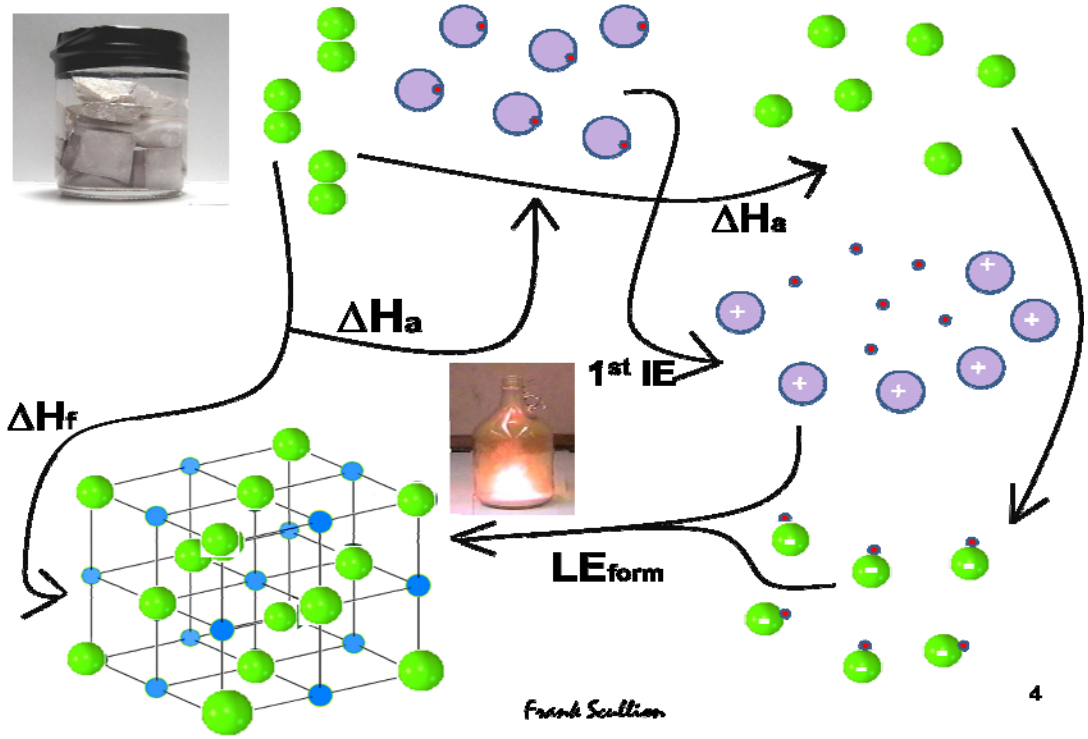
Born Haber Cycles.

All of these questions have been solved www.justchemy.com

Question 1. Determine LE_f of NaCl

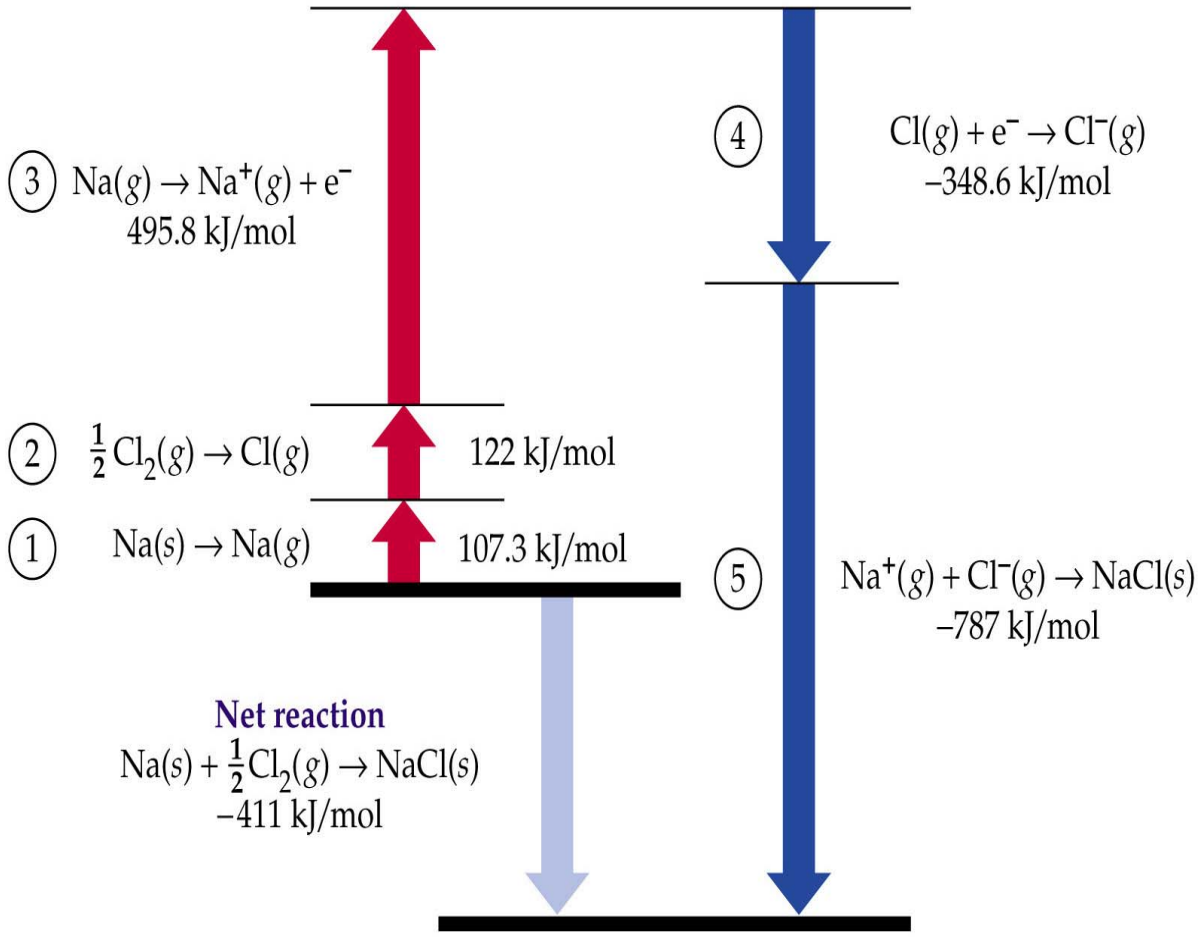
Construct a Born-Haber cycle for the formation of sodium chloride, NaCl, and use the data given below to calculate the Lattice Enthalpy of Formation

$Na(s) \rightarrow Na(g)$	$= +107.3\ kJ\ mol^{-1}$
$Na(g) \rightarrow Na^+(g) + e^-$	$= +495.8\ kJ\ mol^{-1}$
$\frac{1}{2}Cl_2(g) \rightarrow Cl(g)$	$= +122\ kJ\ mol^{-1}$
$Cl(g) + e^- \rightarrow Cl^-(g)$	$= -348.6\ kJ\ mol^{-1}$
$Na^+(g) + Cl^-(g) \rightarrow NaCl(s)$	**to be calculated**
$Na(s) + \frac{1}{2}Cl_2(g) \rightarrow NaCl(s)$	$= -411\ kJ\ mol^{-1}$



Answer LE_f = ( ) + ( ) + ( ) + ( ) + ( )

= - _____ $kJmol^{-1}$



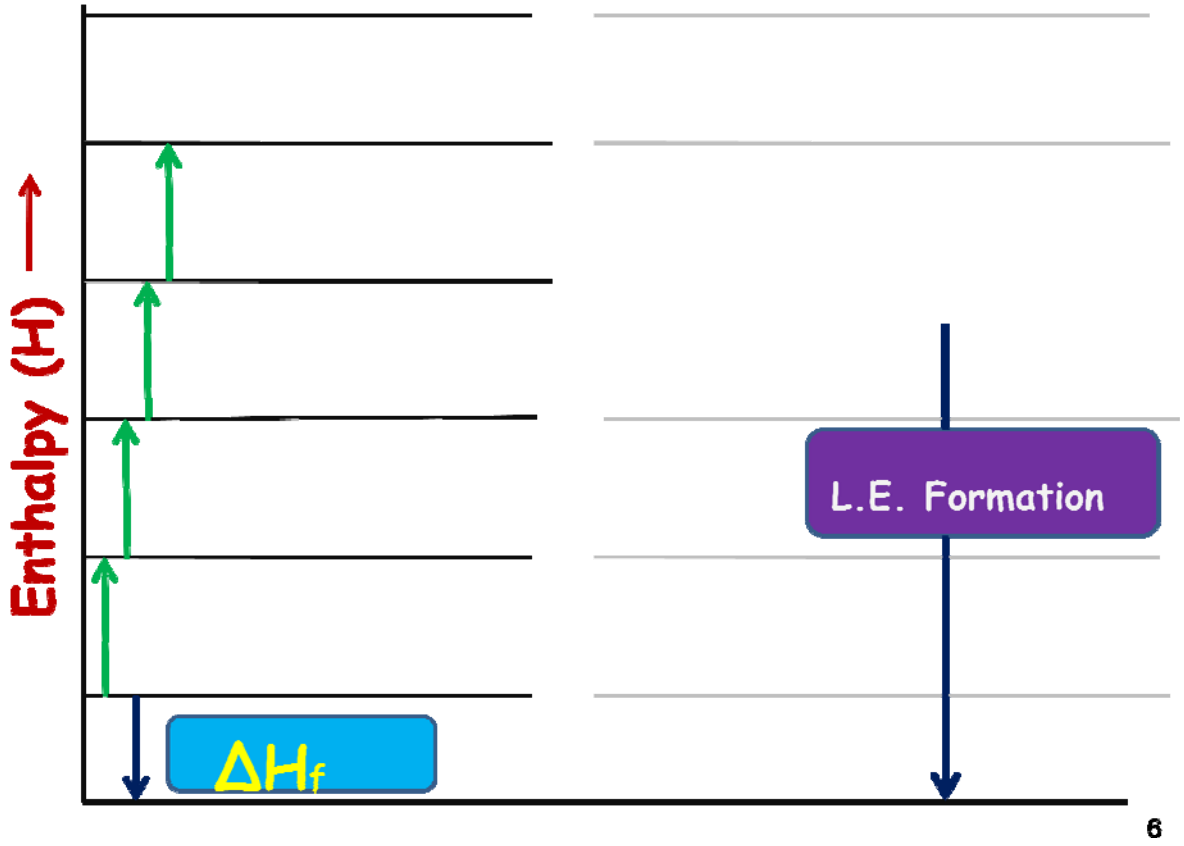
Question 2. Determine LE_f of RbCl

The lattice enthalpy of rubidium chloride, RbCl, can be determined indirectly using a Born-Haber cycle.

(a) Use the data in the table below to construct the cycle and to determine a value for the lattice enthalpy of rubidium chloride.

enthalpy change	energy/kJ mol^{-1}
formation of rubidium chloride	−435
atomisation of rubidium	+81
atomisation of chlorine	+122
1st ionisation energy of rubidium	+403
1st electron affinity of chlorine	−349

Use this diagram to help you.



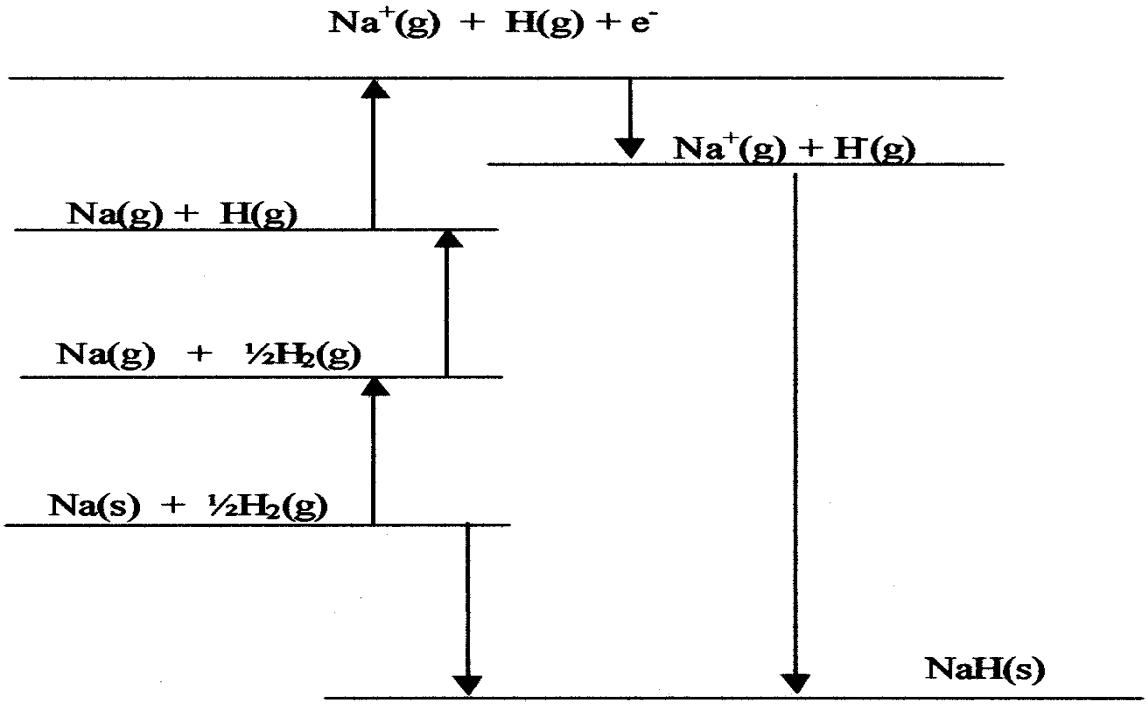
Answer LE_f = ( ) + ( ) + ( ) + ( ) + ( )

= - _____ $kJmol^{-1}$

Question 3. Born Haber Cycle for NaH

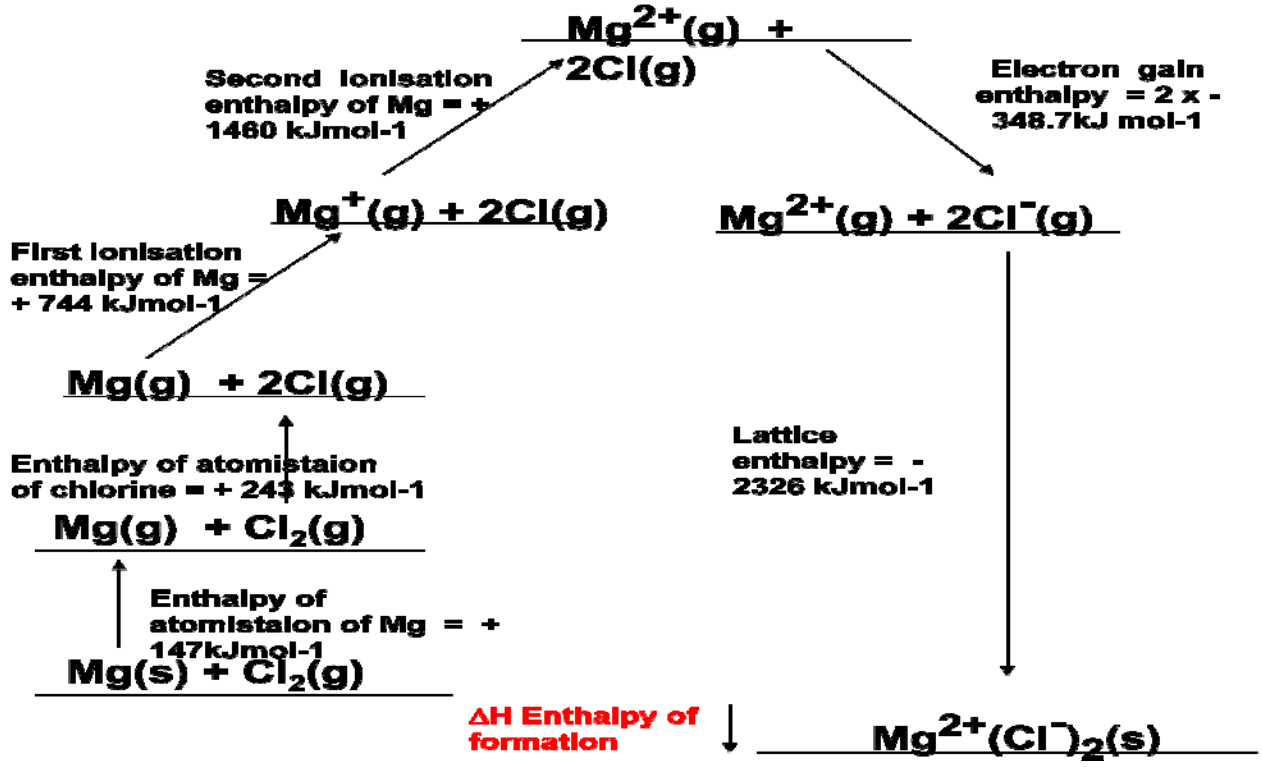
Hydrogen gas reacts with sodium metal to form an ionic solid, NaH, which contains sodium cations. Draw a Born–Haber cycle which could be used to determine the electron affinity of hydrogen.

Note that the Hydride Ion is H^-



Question 4. Determine ΔH_f of $MgCl_2$

Use the Born Haber Cycle below to determine this value.



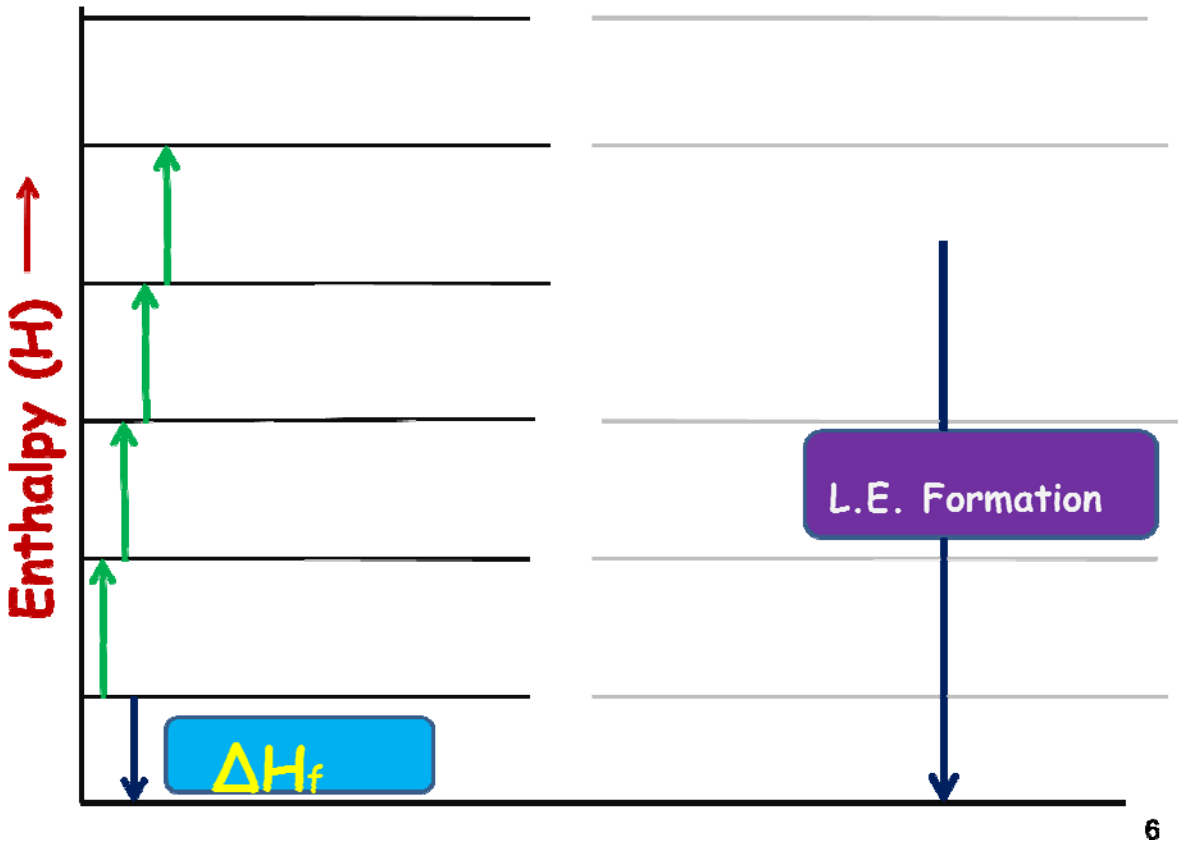
Answer LE_f = ( ) + ( ) + ( ) + ( ) + ( )

= - _____ $kJmol^{-1}$

Question 5. Determine LE_f of MgO

1. Construct a fully-labelled Born-Haber cycle for the formation of MgO and use the data given below to calculate a value for the enthalpy of lattice formation of this oxide

Process	**ΔH /kJ mol–1**
$Mg(s) + O_2(g) \rightarrow MgO(s)$	–602
$Mg(s) \rightarrow Mg(g)$	+148
$Mg(g) \rightarrow Mg^{2+}(g) + e^-$	+738
$Mg^+(g) \rightarrow Mg^{2+}(g) + e^-$	+1451
$O_2(g) \rightarrow 2O(g)$	+498
$O(g) + e^- \rightarrow O^-(g)$	–141
$O^-(g) + e^- \rightarrow O^{2-}(g)$	+798

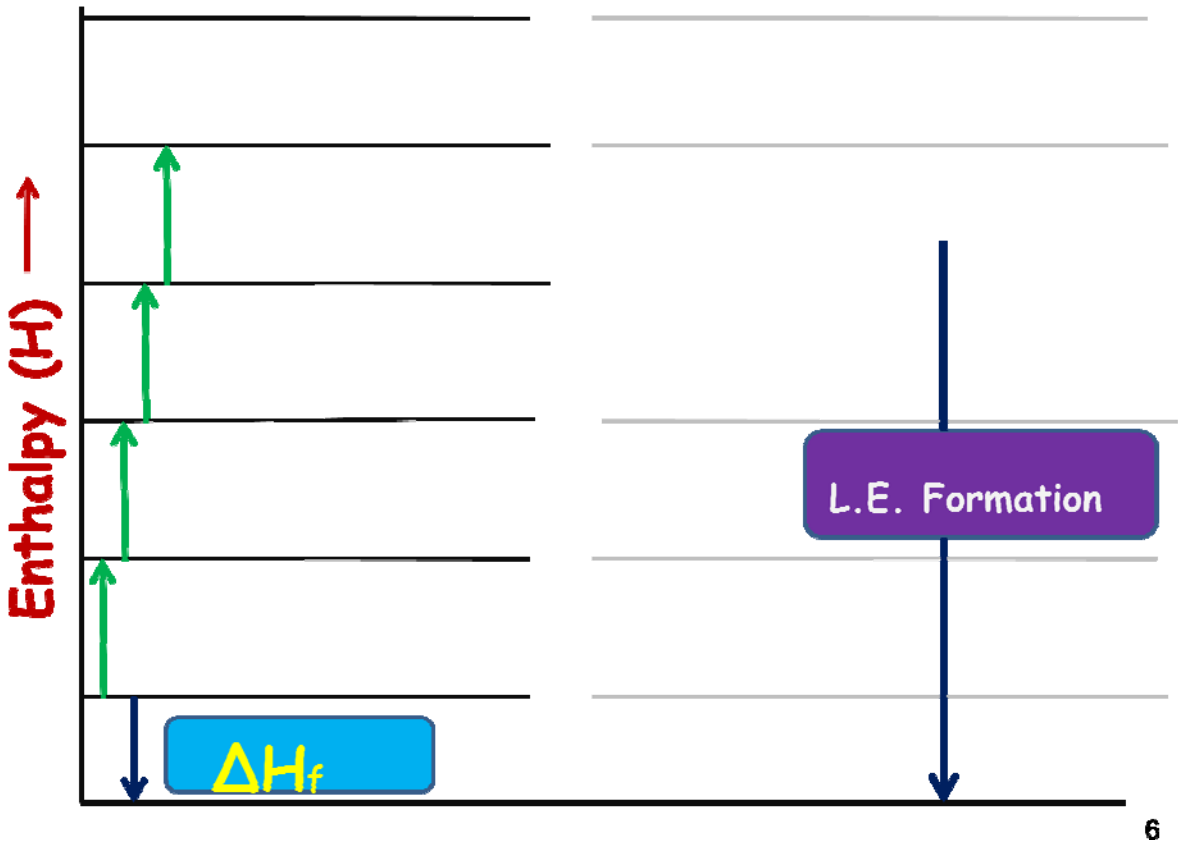


Answer LE_f = ( ) + ( ) + ( ) + ( ) + ( ) + ( )

= - _____ $kJmol^{-1}$

Question 6. Determine LE_f of FeO

Iron (II) oxide:	kJ/mol
Enthalpy of formation	-278
Lattice enthalpy of dissociation	to be found
Iron	
Enthalpy of atomisation	+416
1st ionisation energy	+759
2nd ionisation energy	+1561
Oxygen	
Enthalpy of atomisation	+249
1st + 2nd electron affinity	+657

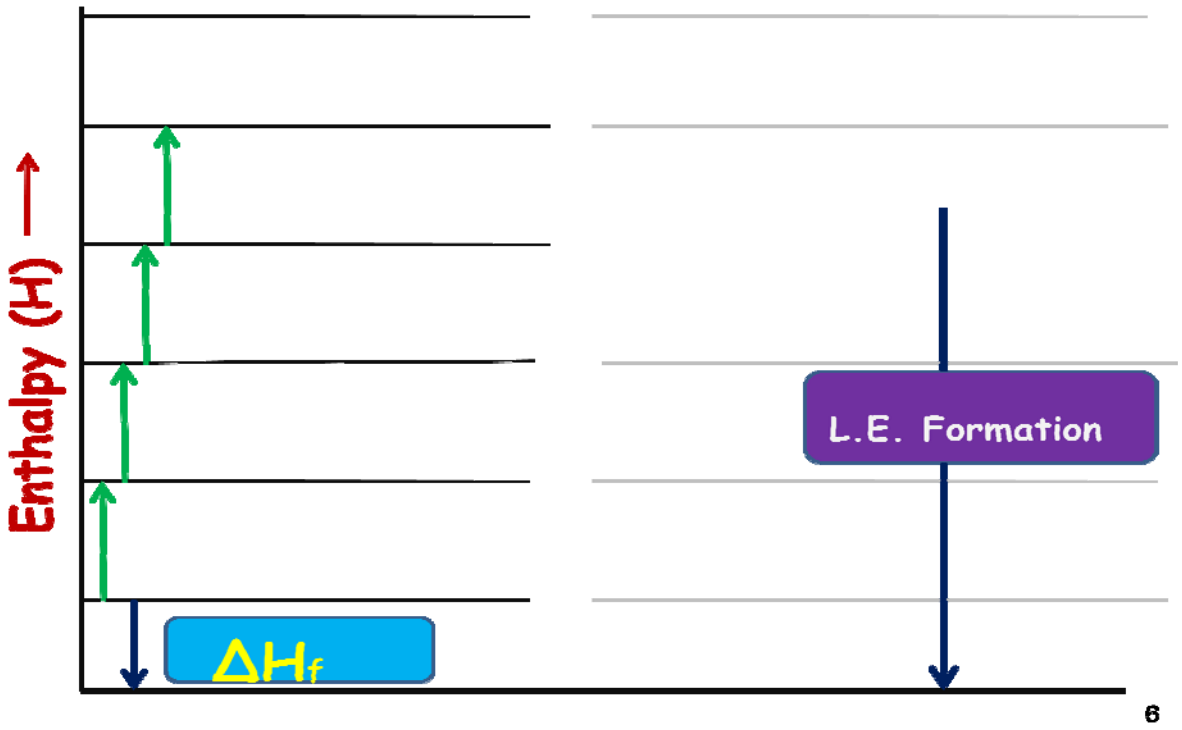


Answer LE_f = ( ) + ( ) + ( ) + ( ) + ( ) + ( )

= - _____ $kJmol^{-1}$

Question 6. Determine LE_f of Al_2O_3

	kJ/mol
Aluminium oxide:	
Enthalpy of formation	-1675.7
Lattice enthalpy of dissociation	to be found
Aluminium	
Enthalpy of atomisation	+326
1st ionisation energy	+577.6
2nd ionisation energy	+1816.6
3rd ionisation energy	+2744.7
Oxygen	
Enthalpy of atomisation	+249
1st + 2nd electron affinity	+657

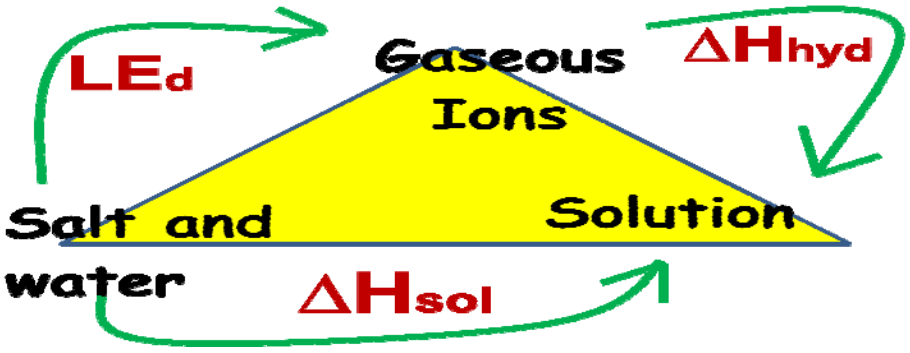


( ) + ( ) + ( ) + ( ) + ( ) + ( ) + ( ) + ( )

= - _____ kJmol^{-1}

Also study the energy cycles that tie together: -

- Lattice Energy
- Enthalpy of Hydration
- Enthalpy of Solution



F Scullion. All of the above solved at www.justchemy.com