Born–Haber cycles

Page 1: Enthalpy changes for NaCl

Print on stiff paper or card and then laminate to make them more durable.

**NaCl(s)**

**Na(s) + ½Cl2(g)**

D*H*~~o~~le Lattice enthalpy of sodium chloride

**-** 790 KJ mol-1

D*H*~~o~~f Enthalpy of formation of sodium chloride

**-** 415 KJ mol-1

D*H*~~o~~ie First ionisation enthalpy of sodium

 Na(g) +496 KJ mol-1 Na+(g)

D*H*~~o~~at Atomisation

 enthalpy of sodium

107 KJ mol-1

D*H*~~o~~at Atomisation

 enthalpy of chlorine

+ 121 KJ mol-1

Cut out the cards.

D*H*~~o~~ea First electron affinity of chlorine

 Cl-(g) **-** 349 KJ mol-1 Cl-(g)

Page 2: Additional enthalpy changes for MgCl2

D*H*~~o~~ie Second ionisation enthalpy of magnesium

 Mg+(g) + 1451 KJ mol-1 Mg2+(g)

You will also need to use the enthalpy of atomisation and first
electron affinity for chlorine from page 1 and the lattice enthalpy
for MgCl2 from the A3 sheet to complete the cycle.

**MgCl2(s)**

**Mg(s) + Cl2(g)**

D*H*~~o~~f Enthalpy of formation of magnesium chloride

**-** 643 KJ mol-1

D*H*~~o~~ea First electron affinity of chlorine

 Cl-(g) **-** 349 KJ mol-1 Cl-(g)

D*H*~~o~~ie First ionisation enthalpy of magnesium

 Mg(g) + 738 KJ mol-1 Mg+(g)

D*H*~~o~~at

Atomisation

 enthalpy of magnesium

+ 148 KJ mol-1

D*H*~~o~~at Atomisation

 enthalpy of chlorine

+ 121 KJ mol-1

Page 3: Additional enthalpy changes for Na2O and MgO

You will also need to use the enthalpy of atomisation and ionisation energies for sodium and magnesium from pages 1 and 2, as well as the lattice enthalpies for Na2O and MgO from the A3 sheet to complete the cycles.

O(g) **-** 141 KJ mol-1

**Mg(s) + ½O2(g)**

D*H*~~o~~f Enthalpy of formation of magnesium oxide

**-** 593 KJ mol-1

**2Na(s) + ½O2(g)**

D*H*~~o~~ea First

electron affinity

of oxygen

D*H*~~o~~ie First ionisation enthalpy of sodium

Na(g) + 496 KJ mol-1 Na+(g)

D*H*~~o~~at Atomisation enthalpy
of oxygen

+ 249 KJ mol-1

**Na2O(s)**

D*H*~~o~~ea Second electron affinity of oxygen

 O**-**(g) **+** 753 KJ mol-1 O2**-**(g)

D*H*~~o~~f Enthalpy of formation of sodium oxide

**-** 461 KJ mol-1

D*H*~~o~~at Atomisation

 enthalpy of sodium

107 KJ mol-1

**MgO(s)**

D*H*~~o~~le Lattice enthalpy of magnesium oxide

 -3791 KJ mol-1

Page 4: Lattice enthalpies for MgCl2,
 Na2O and MgO.

Extension piece for MgO. ↓

Print on stiff paper or card and then cut out the individual cards. Laminate the cards to make them more durable and join the extension pieces as shown using clear sticky tape.

Extension pieces for MgCl2 and Na2O. →

D*H*~~o~~le Lattice enthalpy of magnesium chloride

 -2524 KJ mol-1

D*H*~~o~~le Lattice enthalpy of sodium oxide

 -2528 KJ mol-1

Attach extension piece here

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Attach extension piece here ↑

Attach extension piece here ↑