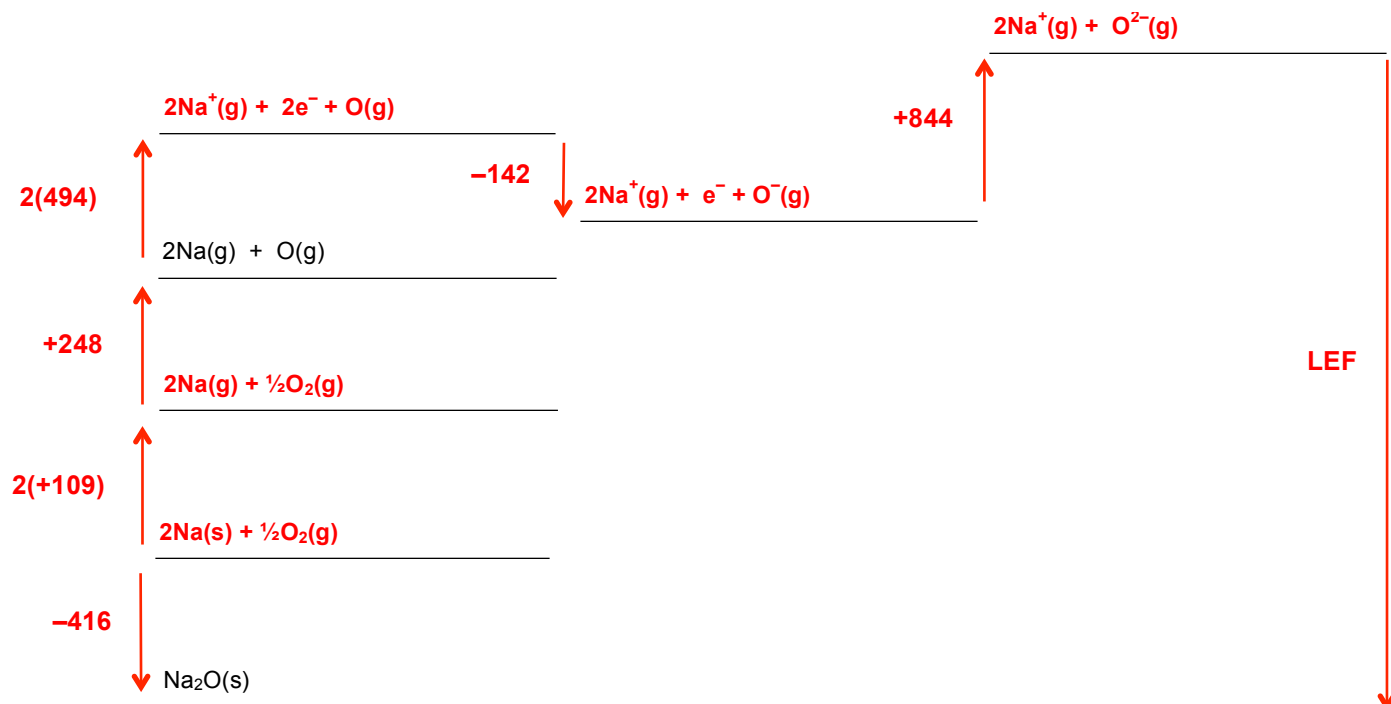# THERMODYNAMICS (C)

a Complete the Born Haber cycle below for sodium oxide. Complete the lines, put arrows from one stage to another, and write on the values for the enthalpy change for each step on those arrows using the data below.

2Na$^+$(g) + O^{2-}(g)

2Na$^+$(g) + 2e$^-$ + O(g)

2(494)

−142

+844

2Na$^+$(g) + e$^-$ + O$^-$(g)

2Na(g) + O(g)

+248

LEF

2Na(g) + ½O$_2$(g)

2(+109)

2Na(s) + ½O$_2$(g)

−416

Na$_2$O(s)

enthalpy of formation of sodium oxide = −416 kJ mol^{-1}

1st ionisation enthalpy of sodium = +494 kJ mol^{-1}

1st electron affinity of oxygen = −142 kJ mol^{-1}

2nd electron affinity of oxygen = +844 kJ mol^{-1}

atomisation enthalpy of oxygen = +248 kJ mol^{-1}

atomisation enthalpy of sodium = +109 kJ mol^{-1}

b Calculate the lattice enthalpy of formation for sodium oxide using the cycle.

−416 = 2(+109) + 248 + 2(494) − 142 + 844 + LEF

LEF = −416 − 2(+109) − 248 − 2(494) + 142 − 844

LEF = −2572 kJ mol^{-1}