IB Chemistry ENERGETICS: Lattice enthalpies

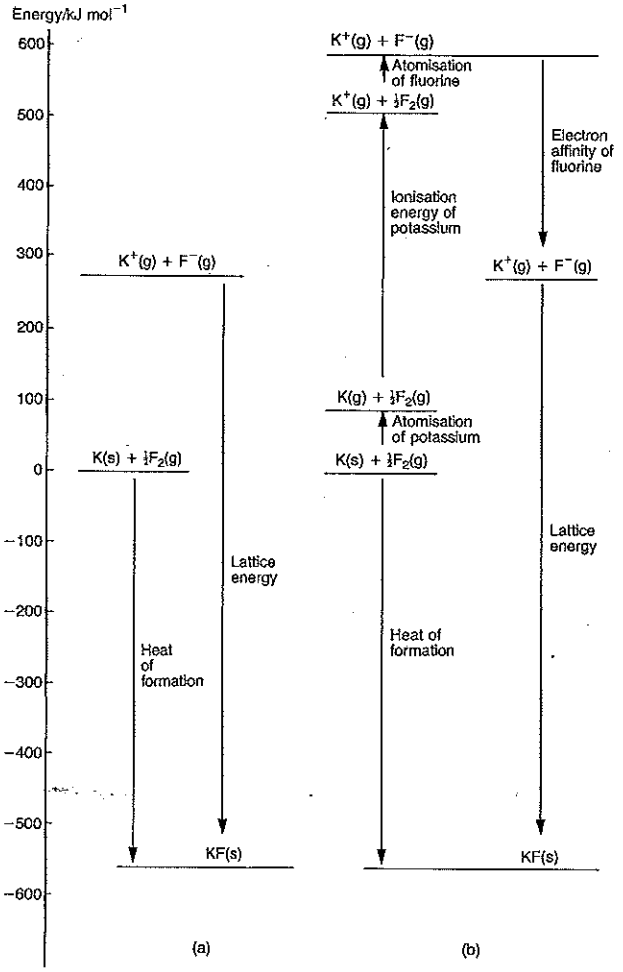

Figure 46.1 *Using energy diagrams to calculate the lattice energy of potassium fluoride*

Change	*Enthalpy change*	*Value* /kJ mol^{-1}
$K(s) + \frac{1}{2}F_2(g) \rightarrow KF(s)$	Heat of formation	−562.6
$K(s) \rightarrow K(g)$	Heat of atomisation	+89.6
$K(g) \rightarrow K^+(g)$	First ionisation energy	+419.0
$\frac{1}{2}F_2(g) \rightarrow F(g)$	Heat of atomisation	+79.1
$F(g) \rightarrow F^-(g)$	First electron affinity	−332.6

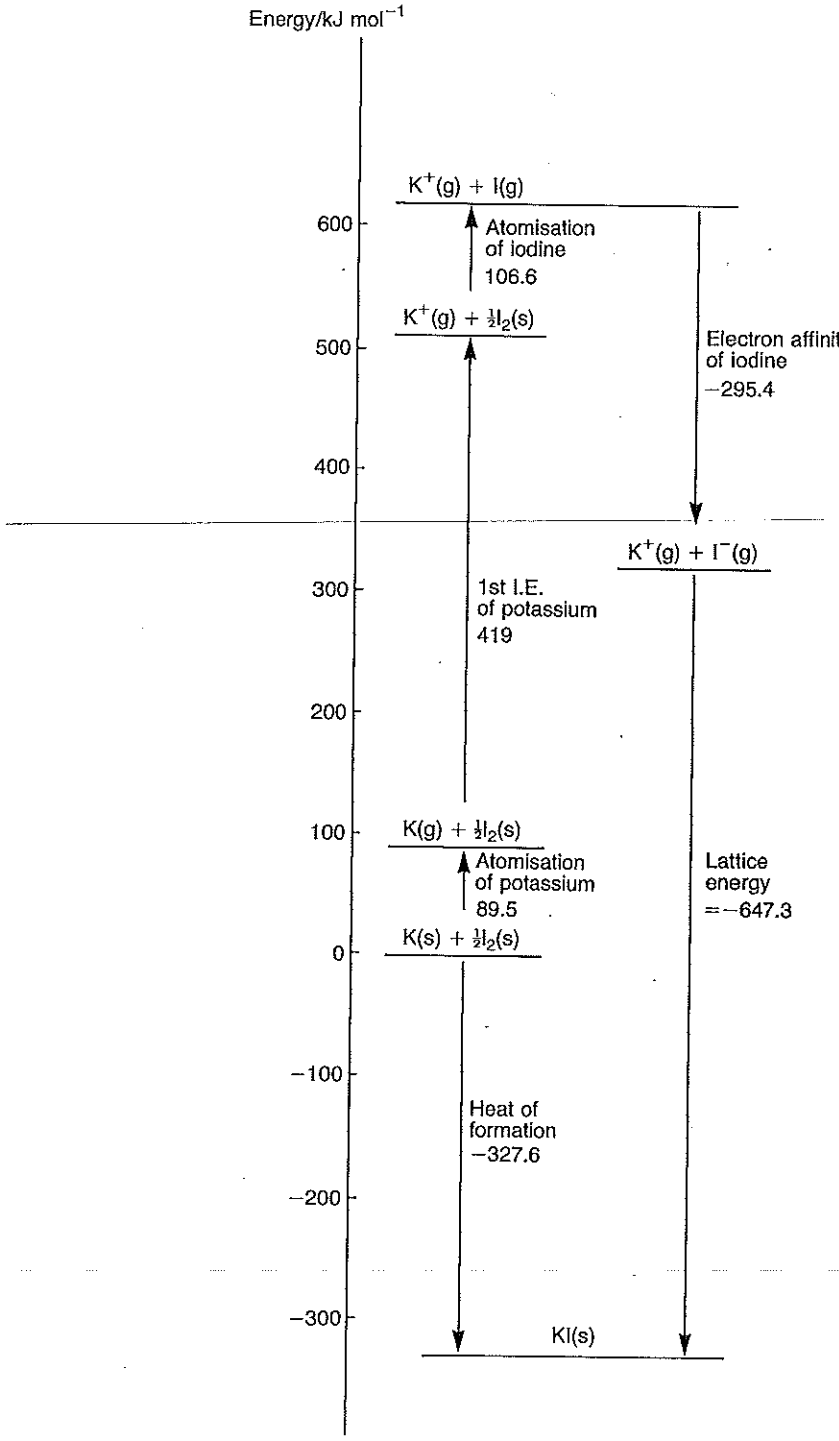

Figure 46.6 *Born–Haber cycle for potassium iodide. Check: −(lattice energy) = −(−327.6) + 89.5 + 419 + 106.6 − 295.4 = 647.3. Therefore, lattice energy = −647.3 kJ mol^{-1}*

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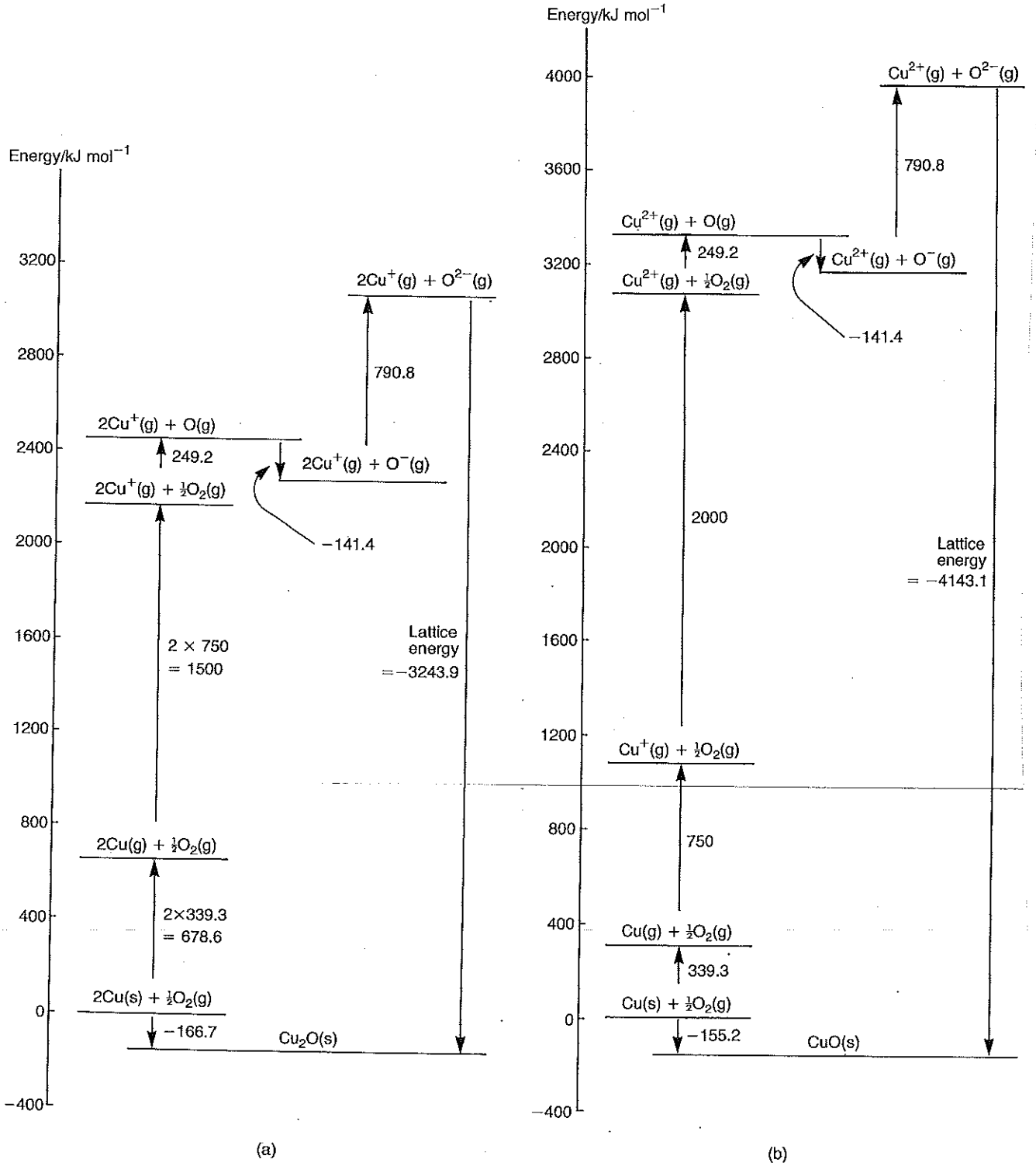

Figure 46.5 *(a) Born–Haber cycle for copper(I) oxide. Check: −(lattice energy) = −(−166.7) + 678.6 + 1500 + 249.2 − 141.4 + 790.8 = 3243.9. Therefore, lattice energy = −3243.9 kJ mol^{-1}. (b) Born–Haber cycle for copper(II) oxide. Check: −(lattice energy) = −(−155.2) + 339.3 + 750 + 2000 + 249.2 − 141.4 + 790.8 = 4143.1. Therefore, lattice energy = −4143.1 kJ mol^{-1}*

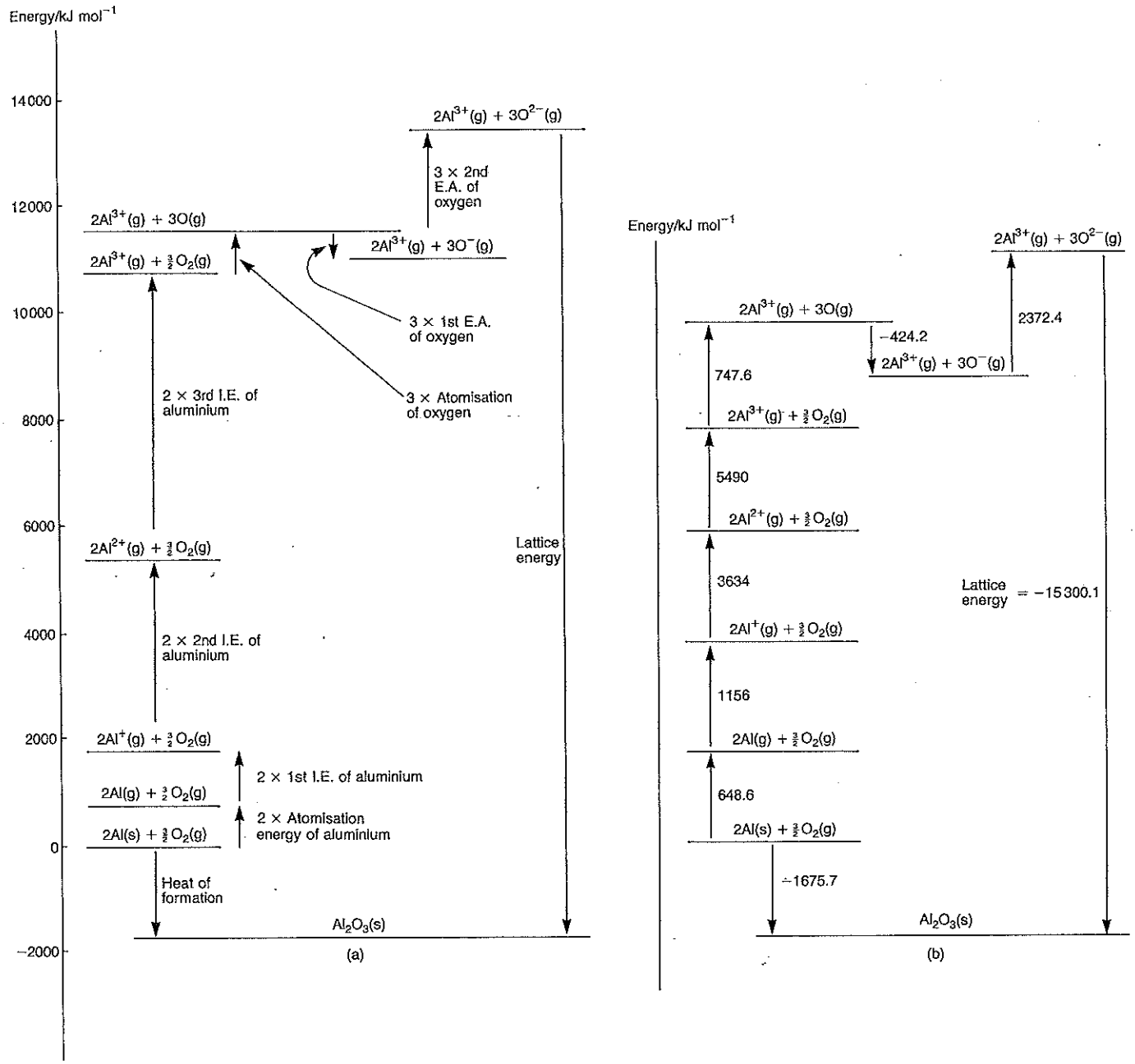

Figure 46.2 *(a) The Born–Haber cycle for aluminium oxide. (b) This diagram is not drawn to scale. It merely shows the values of the energy changes in the Born–Haber cycle*

Change	*Enthalpy change*	*Value* /kJ mol^{-1}	*Multiply by*
$2Al(s) + \frac{3}{2}O_2(g) \rightarrow Al_2O_3(s)$	Heat of formation	−1675.7	1
$Al(s) \rightarrow Al(g)$	Heat of atomisation	+324.3	2
$Al(g) \rightarrow Al^+(g)$	First ionisation energy	+578	2
$Al^+(g) \rightarrow Al^{2+}(g)$	Second ionisation energy	+1817	2
$Al^{2+}(g) \rightarrow Al^{3+}(g)$	Third ionisation energy	+2745	2
$\frac{1}{2}O_2(g) \rightarrow O(g)$	Heat of atomisation	+249.2	3
$O(g) \rightarrow O^-(g)$	First electron affinity	−141.4	3
$O^-(g) \rightarrow O^{2-}(g)$	Second electron affinity	+790.8	3