23 Lattice energy and electron affinity – Part 1

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	中文	Write it 3 times (English)		
enthalpy changes	焓变			
lattice energy	晶格能			
enthalpy change of atomisation	原子化焓变			
electron affinity	电子亲和能			

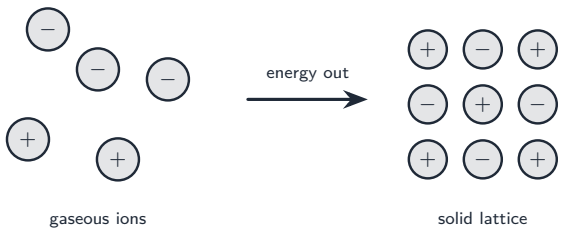
Recall

Born–Haber cycles use **enthalpy changes** 焓变 (ΔH). Two new ones describe forming gaseous atoms and the ionic solid.

New ideas

Read these first, then do the Practice.

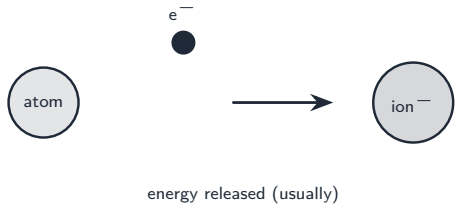
1 Lattice energy



The **lattice energy** 晶格能 is the energy change when one mole of an ionic solid forms from its gaseous ions. It is always *negative* (strong bonds form). The **enthalpy change of atomisation** 原子化焓变 (to make gaseous atoms) is always positive.

Worked example. For sodium chloride, gaseous Na^+ and Cl^- ions come together into the solid lattice and release energy, so its lattice energy is a large *negative* value (about -787 kJ mol^{-1}).

2 Electron affinity



The first **electron affinity** 电子亲和能 is the energy change when gaseous atoms each gain one electron to form 1− ions. It is usually negative.

Watch out: lattice energy is *negative* (ions attract, energy out); atomisation and ionisation are *positive* (energy in). The *first* electron affinity is usually negative, but the *second* is positive — you must push an electron onto an already-negative ion.

Practice

Try these in order.

23.1 Is the *lattice energy* positive or negative? [1]

23.2 Why does that sign make sense? [1]

23.3 What is the *enthalpy change of atomisation*? [1]

23.4 What is the first *electron affinity*? [1]

23.5 Is the first electron affinity usually positive or negative? [1]

23.6 Challenge. Magnesium oxide ($Mg^{2+}O^{2-}$) has a much more negative lattice energy than sodium chloride ($Na^{+}Cl^{-}$). Explain why, in terms of ionic charge. [2]