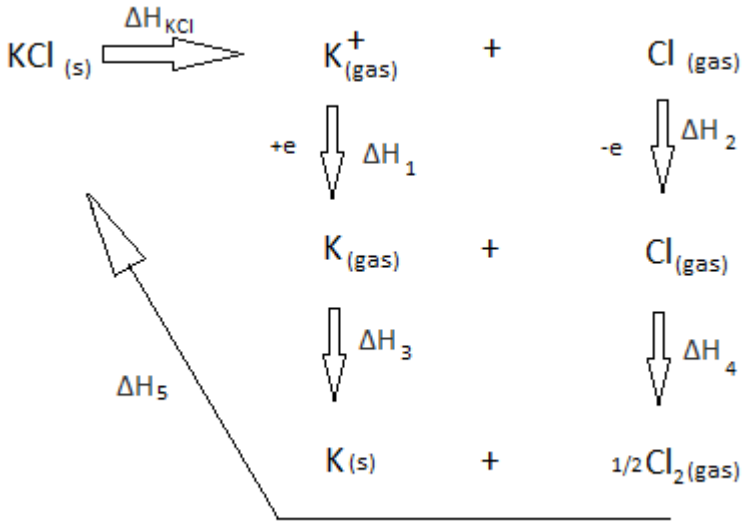
Question #48812, Chemistry, Inorganic Chemistry

Arrange the following ionic compounds in
order of increasing lattice energy KC1, KBr,
CaCl2 and MgCl2
Give reason for your order

Answer:

To determine the energy of the crystal lattice can be used thermodynamic cycle Bourne.

For example, analyze KCl:



ΔH_{KCl}=-(ΔH_1+ΔH_2+ΔH_3+ΔH_4+ΔH_5)=730 kJ/mol

ΔH_1 -ionization potential of potassium (with opposite sign)

ΔH_2-electron affinity of chlorine atom (with opposite sign)

ΔH_3-thermal effect in the condensation of gaseous potassium

ΔH_4-thermal effect on recombination of chlorine atoms

ΔH_5-Standard enthalpy of formation combustion $K_{(metal)}$ in $Cl_{2\ (gas)}$

ΔH_{KBr}=677.5 kJ/mol

ΔH_{MgCl2}=2500 kJ/mol

ΔH_{CaCl2}=2240 kJ/mol

You can calculate the energy of the formula Bourne:

$$\Delta U = N_a * A\frac{Z_1 Z_2 e^2}{4\pi\varepsilon r}(1\text{-}1/n)$$

$$n=1+\frac{18r^4}{Ae^2\beta}$$

β-compressibility factor of the crystal

A - Madelung constant

$KBr < KCl < CaCl_2 < MgCl_2$
